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DIGITIZATION OF PROCESSES FOR A CONSISTENTLY HARMONIZED SECURITY AND SERVICE CONCEPT IN AIR TRANSPORTATION

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Abstract

A long-term characteristic of the air transport system is a continuously growing number of travellers all around the world. There are major problems inherently related to this still emerging number of passengers on airports and within aircraft: On the one hand the vulnerability of the system against crime has to be minimized, and, on the other hand, automation of existing and new services has to be maximized to cope with this growth process at reasonable cost. The approach for solving this challenge is the harmonization and digitization of the airport and aircraft cabin processes by introducing a universal digital process key. This process key, functioning as a secure token, enables the passenger to fulfill the required interactions within the full range of travel using only a single device. By the implementation of this method, which can be based on the future oriented near field communication (NFC) technology, advantages for both security and service level can be created for all involved stakeholders, such as passengers, airlines, airports and authorities.

1 INTRODUCTION

To enhance security in the air transport system several corrective and preventive measures have been taken in the past, protecting airports and aircraft from terrorism and criminality. In civil aviation the two basic principles of airport security are to ensure perimeter security of the system and to guarantee trustworthiness of individuals travelling within the system by security checks and secure identification. Although these security measures are commonly accepted by the majority of people, methods like surveillance, intensive screening or tracking and tracing are often perceived negative and unpleasant by passengers. Current aspects will be discussed within section 2 “Travelling Today”.

Unfortunately it is seldom recognized that a liaison of airport security and pas-

senger service could dramatically improve and outweigh the negative impression of security measures by the favoured positive service aspects. This existing disregard of services results from different spheres of interest of the various stakeholders in the travel process. Border control for instance is a sovereign task and focuses on homeland security whereas airports and airlines want to increase turnover by improving customer relationship and offering amenities to their frequent travellers. Hence, it is important to work on a consistently harmonized security and service concept in air transportation where both the aspects of security and service will benefit from each other. Furthermore it is important to extend this security and service concept from the airport into the aircraft cabin for covering the full transportation chain (Figure 1). This will be discussed within section 3 "Travelling Tomorrow".

Figure 1 – Consistently harmonized security and service concept in air transportation

In the age of mobile electronics novel passenger services are very often provided via wireless interfaces, digitized information is exchanged and self-service is offered via automated processes. Portable electronic devices (PEDs), smart cards, identification systems (ID-systems) and electronic documents (e-documents) nowadays play an increasingly important role, e.g. in e-ticketing and boarding or in frequent flyer programs. Principles, infrastructure and technology for providing these services are very similar and closely related to those used for airport security challenges and sovereign tasks. An approach to use passenger devices with near field communication (NFC) to support the harmonized security and service concept in air transportation will be described in section 4 "Digital Process Key for Passengers".

2 TRAVELLING TODAY

Today's passenger air transport is driven by two major factors: increasing security requirements and further integration of self-service processes [1].

A heated security debate has often led to differing regulations from state to state and controversially discussed introductions of new screening technologies. A series of new information transfer requirements for air travel have been introduced, such as data from the passenger name record (PNR) or the advanced passenger information (API). Further risk assessment and watch list checking programs such as the US-based secure flight initiative or the international expedited traveller (IET) program, promoted by Germany, the Netherlands, the UK and the EU border agency Frontex,

are being discussed or already in their final stage for implementation [2]. The need for information exchange between various databases and overall secure data storage is increasing. This also includes the trend towards a more interactive and real-time based alignment of data. One example is the introduction of interactive API (iAPI) in several countries.

For passengers the identification along the journey and the transmittal of forms and personal data is becoming more complex and increasingly unclear, while at the same time it poses a growing risk on the data protection and privacy rights. At several process steps passengers are asked to authenticate themselves multiple times. Nowadays this often happens by various means of identification, such as a passport, a boarding pass, a frequent flyer or credit card. Figure 2 highlights the essential process steps for current air travel based on the IATA process flow vocabulary [3].

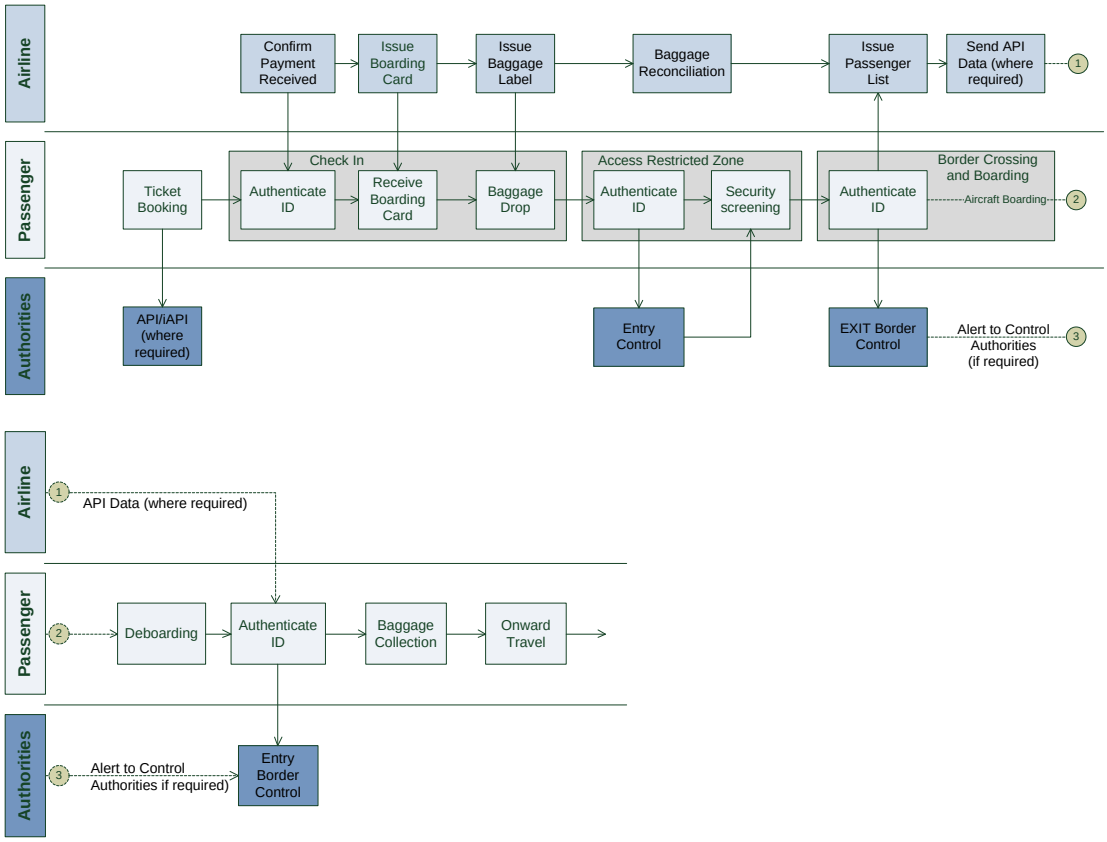

Figure 2 – Overview of today's passenger air travel process

At each step information is transferred from the passenger to the relevant process owner and vice versa. However, there is no consistent information flow between these process owners and important metadata is lost during the journey. Additionally the growing number of today's identification forms increases the likelihood of an internal failure, increases the workload (capacity constraints) for the airport and airline IT systems and finally creates a time-consuming stress and hassle factor for the passenger.

The IATA 'simplifying passenger travel' initiative has started the integration of self-service processes into air transport. The e-ticket and the 2D barcoded boarding pass have become a standard to be used by travellers. Airlines and airports have made

large investments in automation technology to improve process infrastructures at the airport, but there is still an ongoing discussion how secure and capable the current technology, in particular the 2D barcode, will be with respect to future tasks. There is a growing need to store and transport more data on a document and provide a more secure design, such as a link to biometrical data.

Figure 2 clearly shows that the IATA ideal process flow [3] considers only ground procedures dealing with the basic process steps of transport services. The aircraft cabin with the travelling passenger is not part of this model. However, with increasing connectivity of the aircraft cabin, a relocation of processes into the cabin at the aircraft seat and prior to arrival has to be reconsidered. Moreover it gains importance for the airline to offer additional services to their passengers and to create additional revenue onboard. More generally speaking, it is indispensible to include the aircraft cabin into the model and to network with other process steps at the airport and upstream and downstream the airport. Even more important for all stakeholders engaged in future air travel is a marriage of service and security processes.

The complexity of the interlaced process steps and the various service and security aspects can be mastered by modeling the overall system using a formal systems modelling language, such as UML or SysML [4]. Figures 2 and 3 use a graphical interface to illustrate the model and depict the high level process elements which can be refined to any amount of detail, culminating in software code for a technical subsystem. This approach is capable to lead to a harmonized security and service concept. Technical and non-technical requirements of each stakeholder can be considered in this model and deployed and integrated into existing infrastructures. A way forward will be described in the next section.

3 TRAVELLING TOMORROW

In future air transportation the key challenges remain: the need for enhancing security of the overall system, coping with growing passenger numbers and driving costs by enabling self-service and processes automation. Therefore our concept focuses on the following key objectives:

- enabling new self-services
- simplifying and standardizing passenger identification
- enhancing aviation security

Figure 3 outlines departure and arrival process steps which are aligned with our approach to achieve these objectives. In analogy to the existing IATA model the scheme focuses on the air travel process, but also includes additional services for passengers. While the overall diagram in figure 3 appears to be complex, the actual underlying process steps have been streamlined and consistently optimized for a continuously digitized process and information flow in-between all process owners. In this outline each process step and the linked services are adapted to the usability of a single electronic device, e.g. an electronic multipurpose document. The electronic format used in such a device will enable a higher automation level for self-service processes, which in turn will simplify the interaction of passengers with the different process owners. On top of that, the approach includes the aircraft cabin with the passenger's seat environment, which is considered to be the central part of an air journey.

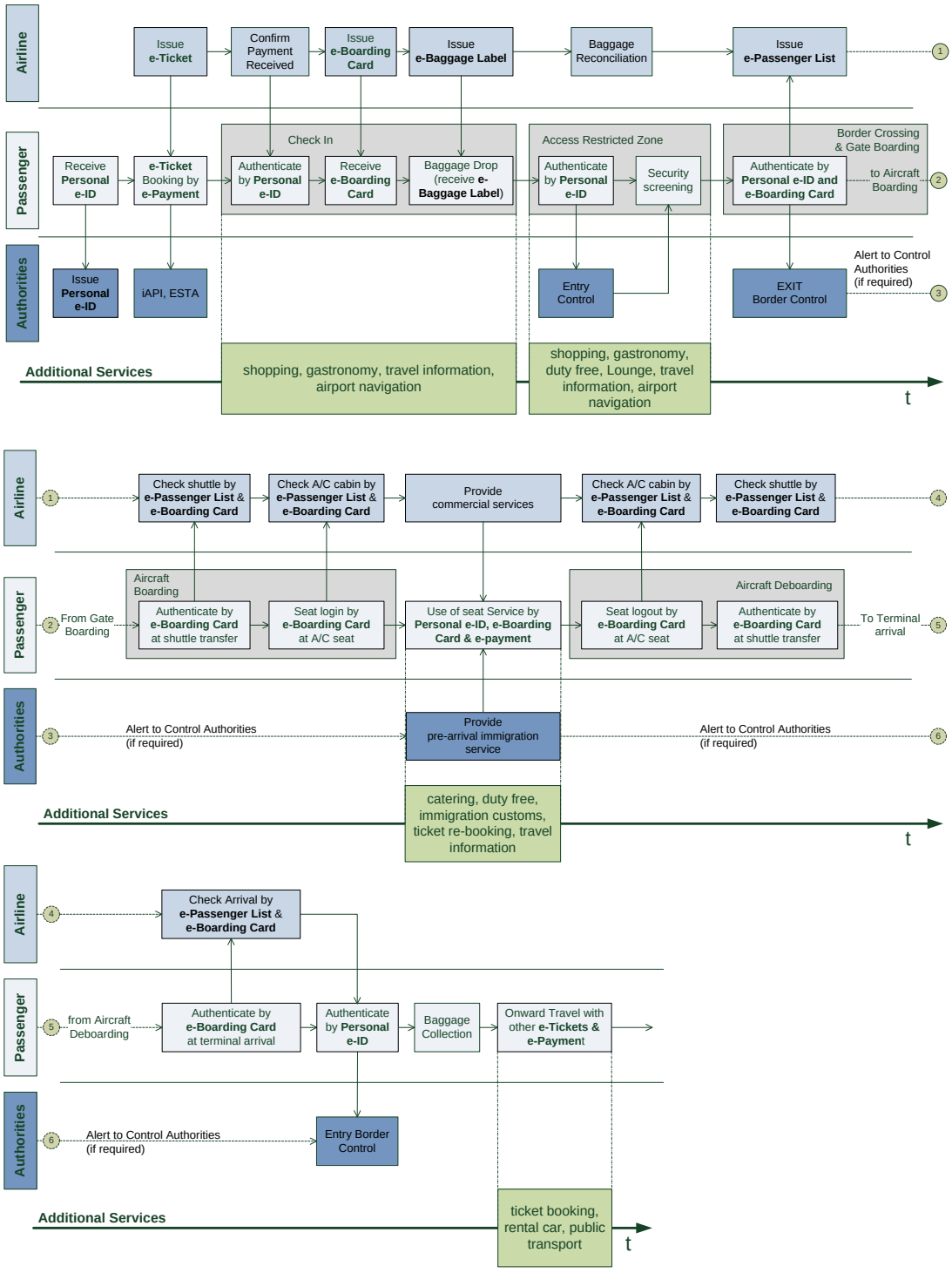

Figure 3 – Overview of the future passenger air travel process

The involvement of the aircraft cabin creates new opportunities to provide commercial or sovereign services in-flight. In the cabin we are proposing the introduction of new process steps called ‘seat login’ (with its counterpart ‘seat logout’), in which a passenger connects himself to a booked seat. By doing so, his or her final cabin position will be verified. Passenger services like in-flight entertainment, cater-

ing, and duty-free shopping can then individually be adjusted. From a security point of view this new process step supports an automated checking procedure of the passenger list.

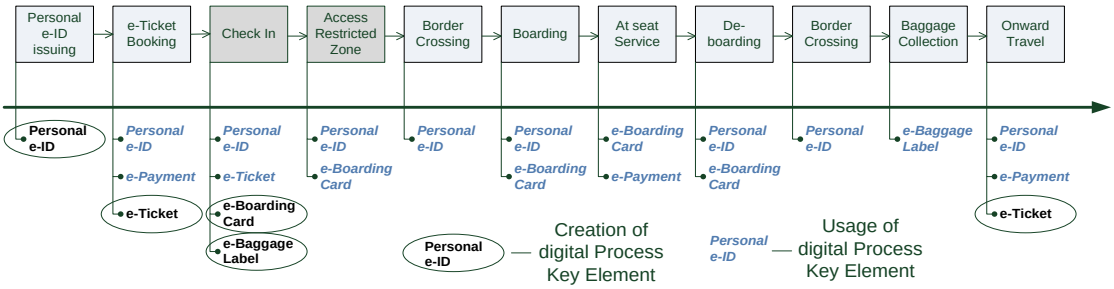

Figure 4 – Example for the creation and use of the digital process key in the travel process

Figure 4 illustrates how passenger identification is used throughout the consecutive process steps with differently graduated characteristics. The trust level of identification differs from authorities to airlines or commercial process owners. Thus it is important to align a single type of electronic identification with all involved process owners in order to reduce interface problems while ensuring data integrity and security. In our scheme "personal e-ID" represents a digital process key element which can be derived from a sovereign ID-document and thus represents the highest trust level in the process. For this reason the personal e-ID element can be used autonomously during the whole journey whenever highly trusted identification is needed. Other digital process key elements, e.g. e-ticket, e-boarding card or e-baggage labeling, are always subordinate to this highest level and derive from the personal e-ID. These elements can be used in different combinations within the process for identification reasons, as depicted in figure 4. In the subsequent three paragraphs it is shown how the digital process key can basically match with our key objectives (enabling new self-services, simplifying and standardizing passenger identification and enhancing aviation security).

Enabling new self-services: Exchanged metadata can be used beneficially by the passenger for location based services, such as the time to gate information, flight information or even for interactive navigation. The digital process key facilitates the individual use of commercial services at the airport and within the aircraft cabin by ensuring availability and completeness of passengers' personal and payment data. The approach fits in frequent flyer programs and onboard ordering services, e.g. for catering or in-flight shopping. When rolled out on a wider scale the digital process key will stimulate revenue generation and ancillary services in areas starting at pre-check-in and culminating in onward travel services.

Simplifying and standardizing identification: The digital process key supports highly trusted identification, because it can be derived from a sovereign ID-document. Highly trusted identification is equivalent to authentication where a person is proving to be the respective person and to have granted rights. Identification can also be used on lower trust levels where a person is only claiming to be the named person. The digital process key accommodates the need for a consistent identification method throughout the whole process on graduated trust levels. It reduces friction within the process steps where the passenger and other relevant process owners are

involved. A simplification of identification in well-defined secured areas can expedite processing time, and even small efficiency gains can add up to a logistical advantage for the overall system. Furthermore the system will enable certain process parties owning the relevant rights, to acquire information and metadata from the passenger. We therefore propose the term "federative ID management" in this context to highlight the fact, that certain parts of information of the process key are shared among the parties dependent on their owned access rights. Exchanged metadata will include information about a passenger status change from "checked-in" to "being successfully screened" and finally "seated". Information on the successful completion of certain process steps will support the overall operational planning of an airline and ground handling staff.

Enhancing aviation security: The ability to correctly identify each person in the process chain is the key tenet of risk-based profiling. Thus the system will most probably be able to support the introduction of passenger grouping and a risk-based assignment of security staff or infrastructure at the security screening checkpoints – the most critical and time consuming part of the process. By a voluntary enrollment of trusted identification data into this system a passenger can provide background information and biometrics at an earlier stage. This method allows a voluntary and secure way of registering low-risk passengers. Furthermore, a voluntarily granted information flow of metadata among the various process steps will allow a reliable tracking of movements across borders to the security authorities and create the opportunity to incorporate the results of the screening process into the end-to-end passenger profile. This feature might be used to support behavioral analysis and can lead to a risk-based management approach in the aviation security strategy which has been discussed by IATA officials lately [5].

In the following section we are describing the development of this common process key, which can be embedded into a portable electronic device (PED) or a smart card by using NFC communication technology.

4 DIGITAL PROCESS KEY FOR PASSENGERS

By taking into account the earlier discussed facts, we finally came out with a technical approach, where a forward-looking travel process chain is seamlessly digitized. Travellers can acquire a digital process key, which is implemented by a token on a portable device such as a smart card or a smartphone. It enables passengers to easily take advantage of the prospective digital process infrastructure with the major benefit of saving process time and being able to use new self-services. Additionally it satisfies all requirements for a higher security level in the air transport processes. A security token is generally used to prove one's identity electronically. In our example the token comprises the following digital process key elements: personal e-ID, e-payment, e-ticket, e-boarding card and e-baggage label, as shown in figure 4 above.

The following figure 5 shows a schematic of a security token with three intrinsic parts used for identification in digitized process chains: the ownership of a specific device (e.g. a smartphone or a smart card), the knowledge of an access code (e.g. a PIN-code) and the inherence of an identifier (e.g. a person's biometric feature). The presence of these three intrinsic parts allows a combined use for trusted identification

on graduated levels and subsequent authorization for the consecutive process steps.

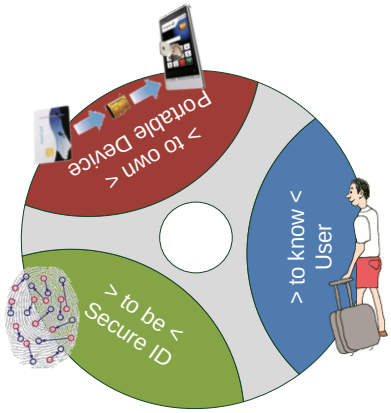

Figure 5 – Three intrinsic parts of a security token

This digital process key concept will technologically be in accordance with the use of sovereign ID-systems, but, different from these, it will not be restricted to identification for sovereign security needs only. On the contrary, the approach pursues the main goal to provide additional passenger services in the foreground and using identification mechanisms in the background to secure personal and operational process steps during air travel.

The token will dynamically acquire process and security information during the travel process. Finally it contains all relevant information to serve required data for subsequent process steps autonomously without the need for additional database synchronization. The following figure 6 schematically shows the use of the token during the process chain.

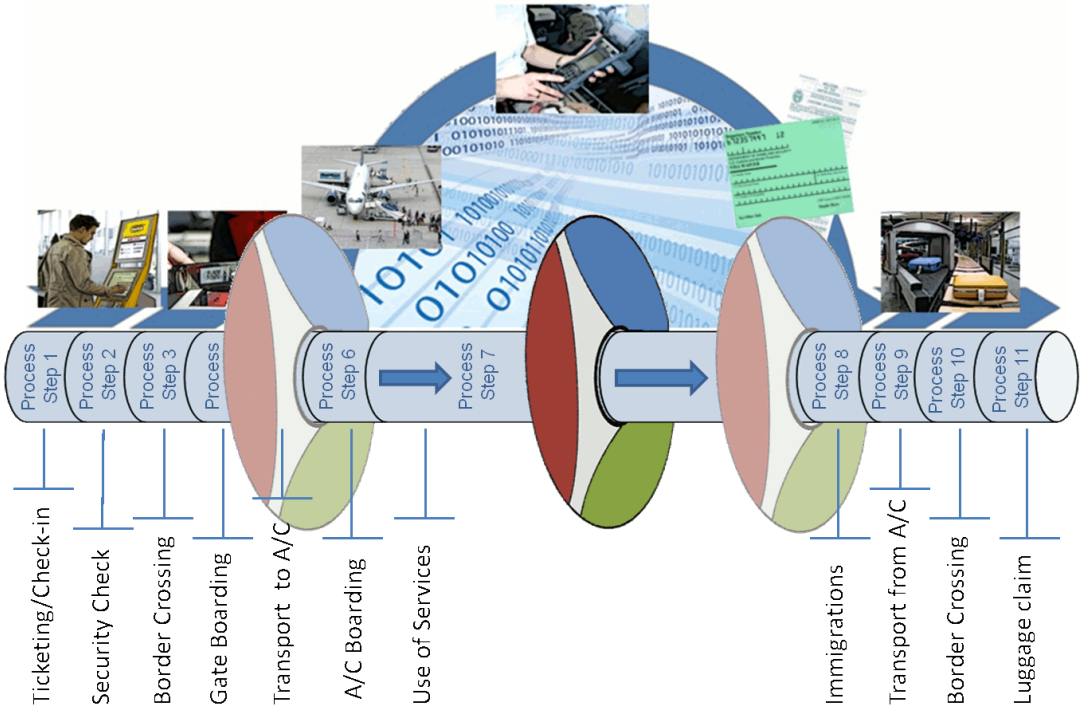

Figure 6 – Process chain at the airport and in the cabin and use of a digital process key

For the technical implementation of this token we are proposing near field communication (NFC) technology which can be embedded into a portable device, preferably a mobile phone. NFC is a short-range wireless connectivity technology that enables simple and safe two-way interactions among electronic devices. It operates in the 13.56 MHz frequency range over a typical distance of a few centimetres. Since the NFC technology is standardized, further developed and supported by an engineering forum comprising the world's leading industry representatives [6] it ensures global interoperability. This engineering and standardization forum includes communication device manufacturers, semiconductor producers, network operators, IT and services companies, as well as financial services organizations to guarantee a worldwide deployment and to cover all aspects of this technology deriving from smart card standards [7, 8]. NFC technology allows consumers to perform contactless identification and transactions, access digital content and connect with others simply by holding the device over a wireless reader. The use of NFC in the transportation sector is currently at the trial stage in many countries worldwide. With regard to the technical implementation of our process key and the system interface, other technological solutions are plausible; nevertheless the NFC technology fulfils several key requirements and is likely to prove as worldwide standard. Key benefits are its interactive short-range specifics along with a shorter set-up time and data security by using a dynamic algorithm to generate a unique transmittal ID for each transfer [9].

5 SUMMARY

Air transport is crucial to the global economy and yet the ongoing introduction of diverse security requirements is often confusing and frustrating for passengers and damaging the reputation and attractiveness of the industry. The predicted growth rates can only be accommodated by the successful implementation of self-service elements and by process automation. Both measures will contribute to facilitate future passenger travel and simultaneously support cost-efficient operation of the overall air transport system. Our approach considers an information and communication technology platform which harmonizes and streamlines security and service processes along the entire air travel process chain. Moreover it includes the aircraft cabin as the central element of the journey, which has been strongly neglected up to now due to technological and aircraft certification reasons.The complexity of interlaced travel process elements in the air transportation will be mastered by modelling the system in a formal systems modelling language, such as UML or SysML.

A specific focus in our approach is the implementation of a common digital process key. This e-token is used to electronically prove travellers identity and serves as a key element for facilitating automated processes, supporting self-service and enhancing security. The e-token can be derived from a government issued ID document. Thus, a traveller will be able to create and use his personal digital process key which will function as an innovative electronic miscellaneous document. It is able to combine e.g. the traditional boarding card, payment certificates, customer status information and many others in a biometrically secured environment. Wireless NFC technology, which derives from the worldwide deployed smart card standards, is considered to be a perfect choice to fulfil the necessary technological requirements.

6 REFERENCES

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