Air Traffic Controller Using A New Ads-B Framework

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ABSTRACT

Now-a-days there are several aircrafts have been lost due to some security issues. This paper overcomes the security issues by proposing a new ADS-B framework, in which it adds up some security. Using the airport authority the exact location, altitude and speed of the aircraft is monitored. In case of any hijacking of aircraft the base station authority can change the destination of aircraft and message can be broadcast between them. This new frameworks consists of three level HIBS (Hierarchical Identity Based System) mechanism and Type-3 batch verification to control n number of aircrafts at a time. The top level PKG generates private keys for the second-level PKGs (the airlines). Each airline is responsible for generating private signing keys for its affiliated aircraft. Each aircraft signs its messages with corresponding signing key and broadcasts the messages together with the signatures. And the signatures are verified in the ground station verifier (the airport).Type 3 batch verification allows multiple signatures on multiple messages generated by multiple signers to be verified at the same time

Keywords : APKG: Airline PKG, ASK: Airline Secret Key, PSK: Plane Secret Key, SKIDA: Airlines secret key, SKIDF: Aircraft secret key.

I. INTRODUCTION

Recently, a new technique will replace conventional radar systems and be deployed as part of the next generation air transportation systems. Unlike in traditional radar systems where aircraft only respond to interrogations by ground stations. In the ADS-B system, aircraft continuously obtain their positions based on some satellite positioning techniques (e.g., GPS) and periodically broadcast their positions as well as some other information such as the current velocity to ground stations and other aircraft. Recently, flight tracker Web sites based on the mash up of ADS-B data have gained popularity, providing Web users with a visual overview of air-traffic around the world.

Each aircraft equipped with this ADS-B device sends messages to other aircraft and the ground station controllers once or twice per second. In the absence of security measures in ADS-B systems makes it susceptible to different attacks. Among the different security threats, this paper overcomes the integrity and authenticity of ADS-B messages.

II. METHODS AND MATERIAL

A. Existing Work

Conventional ATC techniques are based on radar systems which include primary surveillance radars (PSR) and secondary surveillance radars (SSR). PSRs are independent and non-cooperative. Namely, PSRs transmit high-frequency signals, receive the echoes reflected from the aircraft and then can determine the position of the aircraft, without requiring the aircraft's participation. On the other hand, SSRs cooperate with and interrogate the aircraft to get responses which are generated by the onboard systems equipped in the aircraft. The responses may contain information of the aircraft such as identification codes, height, and altitude. However, traditional PSR and SSR systems suffer from some disadvantages such as low precision and high cost.

B. Proposed Scheme

In proposed ADS-B system has ―smart objects‖ that can create a graphical representation of aircraft on the Web. In this a plane object created through mash up of ADS-B data displays the basic ADS-B attributes such as

call sign, registration, altitude, speed and position. Providing ADS-B data with authenticity, which is a main theme of this paper, is also important for the related Web services to maintain high level of reliability. ADS-B data are broadcast through wireless channel (radio frequency data-link) without any cryptographic mechanisms implemented. Besides the ground controllers and aircraft, anyone who holds a single low-cost ADS-B receiver can obtain the ADS-B data.

This paper mainly deals with data integrity and source integrity. Data integrity ensures that the ADS-B data has not been modified upon arriving at the receivers. In this paper, we propose to apply hierarchical identity-based signature (HIBS) to ADS-B authentication and in fact a three-level HIBS is sufficient. The top level PKG could be an authoritative organization such as the ICAO, the FAA or EUROCONTROL. The second level consists of different airlines around the world and the aircraft stand in the third level. In addition, at any time the aircraft or the ground ADS-B receivers will receive a large number of signatures from different surrounding aircrafts which may belong to different airlines and it needs an efficient scheme to verify these signatures as soon as possible. We use batch verification to mitigate this concern. Batch verification is classified into three types, while we deal with the most intractable but desirable one, i.e. type 3. Type 3 batch verification allows multiple signatures on multiple messages generated by multiple signers to be verified at the same time batch verification can be classified into full batch verification and partial batch verification.

In this new framework, it employs a three level HIBS mechanism. The top level PKG generates private keys for the second-level PKGs (the airlines). Each airline is responsible for generating private signing keys for its affiliated aircraft. Each aircraft signs its messages with corresponding signing key and broadcasts the messages together with the signatures. And the signatures are verified in the ground station verifier (the airport).

C. Enhancement

1. We used to control the aircrafts from the belonging airport station.
2. We found the solution to identify the false injected data and data lose in between airports and aircrafts.

3. Both our basic scheme and extended scheme are about five times faster than verifying n signatures independently.
4. No matter how many signatures are verified in batch at one time, we always need only two more parings in the basic scheme than that in the full scheme. There is some more multiplication operations needed in the basic scheme, but these operations are much less time-consuming than the pairing operations and thus have little influence on the computational time.
5. Visually we use the Google map to verify the location of authorized elements and secure data transmission integrity between airports and aircrafts.

D. Advantages

1. Automatic Dependent Surveillance-Broadcast (ADS-B) has become a crucial part of next generation air traffic surveillance technology and will be mandatorily deployed for most of the airspaces worldwide.
2. The number of aircraft has been increasing tremendously over the last decade. So need to verify bulk number of aircrafts using Batch verification.
3. We give a formal security proof for the extended scheme. Experiment results show that our schemes with batch verification are tremendously more efficient in batch verifying n signatures than verifying n signatures independently.
4. With this accurate information, the ground controllers or other surrounding aircraft can monitor and track the location and path of an aircraft, which provides aircraft and the ground controllers a common situational awareness. This improves pilots' decision-making ability dramatically and makes air traffic management much easier.

III. RESULTS AND DISCUSSION

A. Web technology and smart object

Creating website to visually predict and plot our registered airports and aircrafts. The authorized elements from the root PKG (Airport authority of India) only can plot on Google map in our website. Using the highly secured networking socket communication can create the registered and authorized elements could appear on the map. The secured network application communicates

through the authorized internet protocols among them. The root level main authority monitors the every occurrence of elements in the server of the website and verify with the Setup phase algorithm when the element get generated. The authorized element only gets the signatures and keys generated from the authority of root level PKG. On input of a security parameter, the Setup algorithm allows the top PKG to generate the master secret key and the master public key. The root level PKG keeps the master key pair (msk, mpk) that will be used to generate secret keys for low-level nodes.

B. Virtual airport and aircraft nodes

On input of the master secret key, and an airline identity IDA, the Extract A algorithm generates a secret key skIDA for IDA. The Level-1 nodes are airlines each with an identity like IDA. The second level PKGs which can generate the secret signing keys for the bottom level nodes.

Airport nodes are created to controls and communicate with the aircraft nodes. And craft nodes show the important details like range, location, destination, craft number and the source airport of the crafts themselves. Generation of the keys and ids are based on the input of top level PKG (Authority) to the low level PKG (Airlines and aircrafts) using RSA algorithm and HMAC algorithm. Due to this attackers cannot predict the keys and signatures of the nodes

C. Effective communications and controls between Airport and Aircraft:

On input of the secret key skIDA for the Level-2 nodes are the aircraft each with an identity like IDF. The airline identity IDA and an aircraft identity IDF, the Extract F algorithm generates a secret key skIDF for IDF belonging to IDA.

The messages and information's are high sensible and secured. So it could be highly integrated and secured. On the input of skIDF to the registered crafts are controlled and communicated by the source airports among the matched keys and signatures. And matched airports only can communicate with the aircrafts and controlled them automatically from belonged station. Information's from the airport to aircrafts and crafts to station communications can be controlled by ground

station belongs to the aircrafts. After reached the destination, above entire rolls are handled by the destination port.

IV. CONCLUSION

In this paper, we proposed a new ADS-B authentication framework based on three-level hierarchical identity-based signature (HIBS) with batch verification, which can significantly reduce the verification cost. Basing on the framework, we demonstrated two concrete schemes. The basic scheme supports only partial batch verification while the extended scheme provides full batch verification but requiring existing techniques to ensure the integrity of some public values. We gave a formal proof for the security of our extended scheme. The experiment results show that our proposed scheme is much more efficient than traditional ones.

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