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CONTROL OF FLIGHT PARAMETERS WITH CLOUDY TECHNOLOGIES

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Abstract—Considered the problem of storing navigation data used for the analysis of the causes of accidents and their prevention. Offered alternative recording of this data as a program into the cloud storage.

Index Terms—Advanced technology; aircraft; aviation industry; black box; cloud storage; data storage; flight recorder; IT.

I. INTRODUCTION

Today, many Internet users deal with cloud storage. All important information can be stored in the cloud, to avoid losing files because of damage of the hard disk etc. Also it allows using data anywhere, you need only device with Internet access [1].

II. PROBLEM STATEMENT

Recent air crashes in which was lost the data from the flight recorder has forced people to think about making fundamental changes in the system of transmission of flight data. One of the proposed ideas – creating a virtual "black boxes" of the liner with the use of "cloud technologies". This would allow, if necessary, quickly obtain data on the situation on board, including the exact location and route of the plane.

The idea of creating a "cloud black box" was announced by the former head of the State Commission for transport safety USA, retired air force General Mark Rosenker. According to him, the mystery of the Malaysian Boeing 777 tragedy with the Air France plane in 2009, when ships just disappeared from the radar screens and weren't detected, demonstrated the need to change the entire approach to the system of recording data about the flight. Rosenker suggests that a part of the flight information and part of the pilot's negotiations were regularly transferred to a virtual "cloud-based "black boxes". Recorders, on board, will record the entire amount of information which is very large.

Therefore it is necessary to identify the main problems of transition to the cloud, the advantages and disadvantages of integration of cloud technologies into the aviation industry. [2]

III. GENERAL INFORMATION ABOUT THE CLOUD

Cloud storage is a data storage model in which digital data is stored in logical pools physical storage includes multiple servers (often place), and physical environment are usually owned and managed hosting company. Those responsible for cloud storage and their availability, and secure physical environment and running. People and organizations purchase or lease capacity from suppliers to store the user organization or data applications.

A. Advantages of Cloud Storage

Cloud Storage has some advantages, such as:

1. Usability: All cloud storage services reviewed in this topic have desktop folders for Mac's and PC's. This allows users to drag and drop files between the cloud storage and their local storage.

2. Bandwidth: You can avoid emailing files to individuals and instead send a web link to recipients through your email.

3. Accessibility: Stored files can be accessed from anywhere via Internet connection.

4. Disaster Recovery: It is highly recommended that businesses have an emergency backup plan ready in the case of an emergency. Cloud storage can be used as a back-up plan by businesses by providing a second copy of important files. These files are stored at a remote location and can be accessed through an internet connection.

5. Cost Savings: Businesses and organizations can often reduce annual operating costs by using cloud storage; cloud storage costs about 3 cents per gigabyte to store data internally. Users can see additional cost savings because it does not require internal power to store information remotely (Fig. 1).

B. Disadvantages of Cloud Storage

But the Cloud Storage has some disadvantages too, such as:

1. Usability: Be careful when using drag/drop to move a document into the cloud storage folder. This will permanently move your document from its original folder to the cloud storage location. Do a

copy and paste instead of drag/drop if you want to retain the document's original location in addition to moving a copy onto the cloud storage folder.

2. Bandwidth: Several cloud storage services have a specific bandwidth allowance. If an organization surpasses the given allowance, the additional charges could be significant. However, some providers allow unlimited bandwidth. This is a factor that companies should consider when looking at a cloud storage provider.
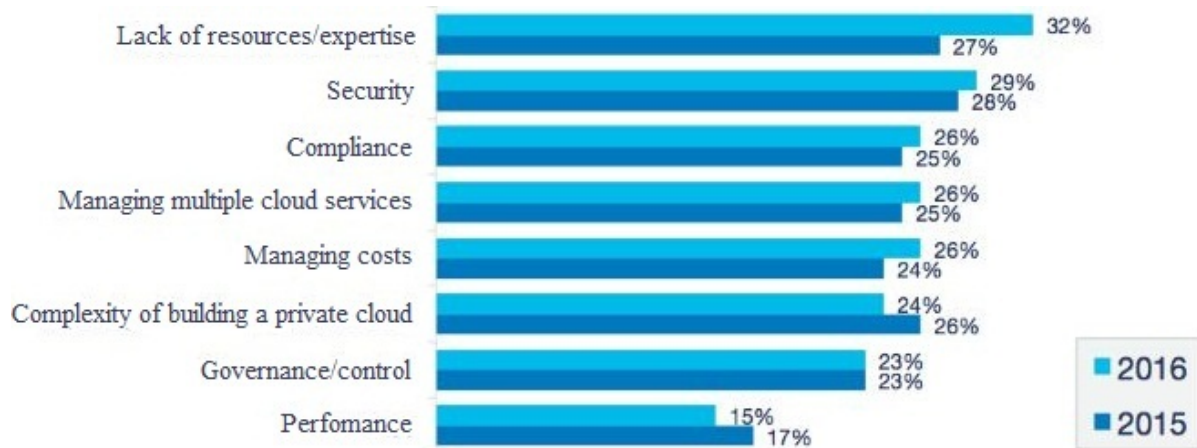

Fig. 1. Comparative characteristics of cloud technologies for 2016 and 2015

3. Accessibility: If you have no internet connection, you have no access to your data.

4. Data Security: There are concerns with the safety and privacy of important data stored remotely. The possibility of private data commingling with other organizations makes some businesses uneasy. If you want to know more about those issues that govern data security and privacy, here is an interesting article on the recent privacy debates.

5. Software: If you want to be able to manipulate your files locally through multiple devices, you'll need to download the service on all devices.

Currently, the most famous cloud services are: Microsoft Azure, Google Drive, iCloud, SkyDrive, Dropbox, Yandex Disk and others. There are also programs that can significantly simplify the work with cloud storage [3].

IV. THE INTEGRATION OF CLOUD TECHNOLOGIES IN AVIATION

With the cloud you can improve the quality of maintenance on the basis of flight data and the condition of the aircraft.

Efficient transmission of real-time flight data of aircraft provides airlines with the opportunity to improve performance, reduce maintenance costs and reduce processing time. All of this ensures a more efficient control at all stages of flight.

Experts note that it is technically possible to create a "cloud-based "black boxes" for ships, but it will be expensive. In a number of leading airlines in Asia, Europe and the United States have begun to introduce a system that will greatly facilitate the task of tracking the flight of the airliner and situations that occur on board, but not all companies can install new equipment in existing aircraft.

Also one of the problems is the need to transfer a very large amount of data that track the situation in the systems of the aircraft.

American manufacturer Boeing also intends to transfer its software products in the field of aviation analytics, which based on cloud technologies, to unified open platform Azure from Microsoft.

The transition to cloud computing is part of Boeing's long-term strategy aimed at increasing the annual income of the company in commercial and military areas from the present 15 billion to $ 50 billion in 2025. In addition, the transition to the cloud allows for more efficient use of the commercial aircrafts, due to increasing of the Internet's role in their operation. In particular, access to the worldwide network offers pilots and aviation personnel access to information resources in real time.

It is expected that due to the processing of information in real time the fuel consumption will be reduced by about 10%.

The necessity of cloud computing is caused by the fact that the aviation industry is characterized by the presence of a vast array of diverse data. For example, such advanced aircraft like the Boeing 787, generating more than 500 GB of data per flight. All of this information comes from thousands of sensors installed on the aircraft. Airlines, in turn, use this information to predict the technical condition of the plane and optimizing the fuel consumption.

Currently, Boeing offers its customers a wide range of analytical tools, including a digital navigation, control, pooling of spare parts, optimization of

operations, improving the effectiveness of mainte-nance programs and the reduction of fuel consump-tion [4].

V. The Advantages of using cloud Technologies in Aviation

The transport becomes more efficient using cloud technologies. This is due to the following advantages.

If the aircraft will spend just 1% less fuel, each aircraft will save annually up to $ 250 thousand. Digital technology can reduce the consumption of aviation fuel. Analysts estimate that such savings could keep a major airline with 500 planes up to $ 100 million a year. To make aircrafts more reliable, Rolls-Royce integrated cloud-based technology of Microsoft in its program Service Solutions. With this program the manufacturer collects and analyses large amounts of data from aircraft. It allows to reduce fuel consumption, improve reliability and efficiency of engines. Nowadays Aircraft engines have hundreds of sensors that transmit gigabytes of data per flight. Engines Rolls-Royce Trent, for example, are using by 85 airlines that serve 50.000 flights per month, or 14 million flight hours per year. This means you need to store and process terabytes of data.

This number will only increase as manufacturers of aircraft, such as Airbus and Boeing increase the number of monitored parameters. Rolls-Royce pre-dicts that in ten years engines will have 7500 pa-rameters, while in 2015 this number was equal to 4600.

Technologies of Microsoft help to develop rec-ommendations for airlines with the most economical use of engines in the air and on the ground.

Having fresh information about the engine pa-rameters in flight, aircraft mechanics can immedi-ately proceed with their maintenance after landing. So it is possible to reduce delays at the airports [1].

VI. The Program for Interacting with cloud Storage

The program is written in Java object-oriented programming language. It provides easy access to data cloud storage Microsoft Azure. Information is given in graphical form, which in turn provides a more convenient way of perception.

In addition to the standard Java libraries special also are used. Facilitating access to cloud storage provides a library sqljdbc41.jar that is the Microsoft JDBC driver for SQL Server. JFreeChart – an open source library for the Java programming language that simplifies the creation of a variety of complex charts and graphs (Fig. 2).
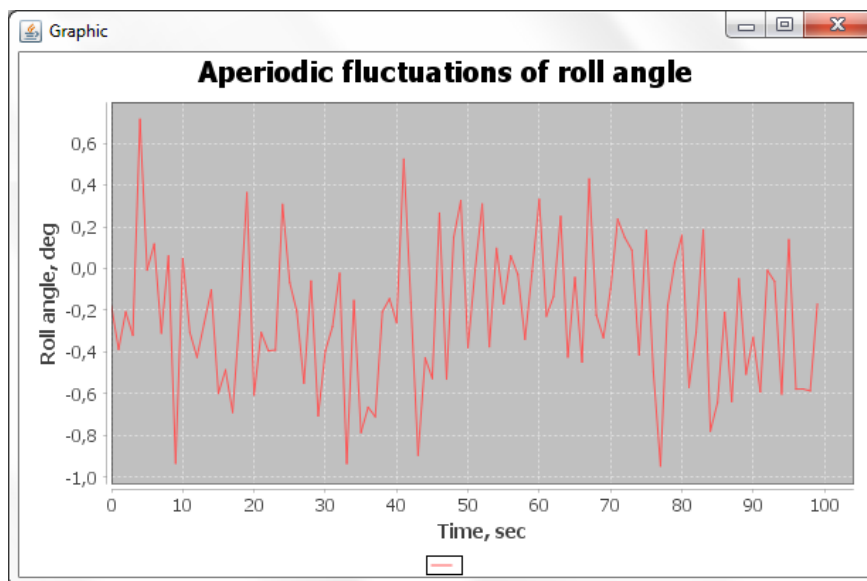

Fig. 2. The results of the program

The work of program is based on the Connector class that provides the connection to the cloud and the Graphic class that displays information in the form of graphs of the dependencies of two quantities.

Each form with the chart is created dynamically, which avoids the use of extra memory.

The access to the cloud storage is allowed for users who know the password. The owner of the cloud on the server registers the IP addresses of those users who is allowed to have access to the data. This mechanism gives additional protection of information.

VII. Conclusions

Overall, despite the flaws, the cloud is now the most popular mechanism for storing data for indi-vidual users and large companies.

After analysis it was found that cloud technologies improve and optimize the tracking parameters of the

flight, allow to use commercial aircraft with more effectiveness.

Every year these technologies improve their performance and gain acceptance in all circles of human activities and implementation of them in the aviation industry make more sense.

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Т. А. Галагуз, Б. Р. Зінченко, О. В. Малишкін. Керування параметрами польоту з хмарними технологіями
Розглянуто проблему збереження навігаційних даних, які використовуються для аналізу причин і попередження аварій і інцидентів. Запропоновано альтернативний варіант запису цих даних у хмарне сховище у вигляді програми.
Ключові слова: хмарні сховища; бортовий самописець; ІТ; зберігання даних; сучасні технології; чорний ящик; авіаційна галузь; повітряне судно.

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Т. А. Галагуз, Б. Р. Зинченко, О. В. Малышкин. Управление параметрами полёта с облачными технологиями

Рассмотрена проблема сохранения навигационных данных, которые используются для анализа причин и предупреждения аварий и инцидентов. Предложен альтернативный вариант записи этих данных в облачное хранилище в виде программы.

Ключевые слова: облачное хранилище; бортовой самописец; IT; сохранение данных; современные технологии; черный ящик; авиационная отрасль; воздушное судно.

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