Multi-Clouds Workload Distribution for the Secure and Reliable Storage of Data under Uncertainty

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Designing IT infrastructures based on cloud technologies must take into account the emerging risks of the security, and reliability due to numerous types of uncertainties associated with cloud computing [Tch1, Cha1].

In this paper, we study systems for storing and processing data in the clouds with the use of residual number systems under conditions of uncertainty. These systems can be represented as oriented graphs $M_{i,j}$, and the workload can be grouped by cloud providers that have different processing power, reliability, and data security.

The basic idea of the load distribution between cloud providers is to increase the probability that each of the cloud systems performs processing at equal intervals T. If any of the cloud providers can not complete the calculations with an acceptable probability, then the computing load is redistributed among other providers or additional computing capacity has to be purchased from this provider.

As an objective function, the sum of the product p_i (probability of data processing V_i by the i-cloud provider in time t) and P_i (probability of access to the results of data processing by an i-cloud provider). It is necessary to determine the values of $M_{i,t}$ for which the objective function is maximal:

$$\sum_{k=1}^{n} \left(p_i\left(M_{i,t}\right) \cdot P_i\left(M_{i,t}\right)\right) \rightarrow \max$$

under conditions of:

1. Security of data storage
2. Security of data processing
3. Project budget
4. Data encoding time in the RNS
5. The decoding time in the Binary.

To solve this problem, we have developed software in the C# programming language in the Microsoft Visual Studio 2015 programming environment, which

allows to simulate a distributed data storage and processing system with real cloud providers: DropBox, Box, Google, Mail, YandexDisk and others.

References

[Tch1] Tchernykh, A., Schwiegelsohn, U., Talbi, E. G.,and Babenko, M.: Towards understanding uncertainty in cloud computing with risks of confidentiality, integrity, and availability. Journal of Computational Science.

[Cha1] Chaisiri, S., Lee, B. S., and Niyato, D.: Optimization of resource provisioning cost in cloud computing. IEEE Transactions on Services Computing, 5(2), 164-177.