Chapter 58
Cloud Computing for BioLabs

Abraham Pouliakis
University of Athens, Greece

Marilena Stamouli
Naval and Veterans Hospital, Greece

Aris Spathis
University of Athens, Greece

Stavros Archondakis
401 General Army Hospital, Greece

Christine Kottaridi
University of Athens, Greece

Efrossyni Karakitsou
National Technical University of Athens, Greece

Antonia Mourtzikou
University of Athens, Greece

Petros Karakitsos
University of Athens, Greece

ABSTRACT

Cloud computing has quickly emerged as an exciting new paradigm providing models of computing and services. Via cloud computing technology, bioinformatics tools can be made available as services to anyone, anywhere, and via any device. Large bio-datasets, highly complex algorithms, computing power demanding analysis methods, and the sudden need for hardware and computational resources provide an ideal environment for large-scale bio-data analysis for cloud computing. Cloud computing is already applied in the fields of biology and biochemistry, via numerous paradigms providing novel ideas stimulating future research. The concept of BioCloud has rapidly emerged with applications related to genomics, drug design, biology tools on the cloud, bio-databases, cloud bio-computing, and numerous applications related to biology and biochemistry. In this chapter, the authors present research results related to biology-related laboratories (BioLabs) as well as potential applications for the everyday clinical routine.

INTRODUCTION

"Leveraging cloud computing technology, bioinformatics tools, can be made available as services to anyone, anywhere, and through any device. The use of large bio-datasets, its highly demanding algorithms, and the hardware for sudden computational resources makes large-scale bio-data analysis an attractive test case for cloud computing" (Hsu, Lin, Ouyang, & Guo, 2013). Cloud computing is a rather new concept related to numerous computers that use Internet infrastructure to communicate producing shared resources such as software, hardware and storage. Nowadays, cloud computing is not widely used for the various tasks related to medicine; however,

there are numerous fields that are possible to be applied; thus cloud computing is an emerging field having the potential to change the everyday practice of medicine. The exception to this is the application of cloud for biology and biochemistry where cloud computing has been already applied, and there are numerous paradigms providing novel ideas and state of the art techniques, these paradigms stimulate as well future research in the based on the cloud environment

Within this chapter, we analyze the application of cloud computing technology for the use in the everyday routine of BioLabs, how to efficiently manage images, use applications, infrastructure, storage and processing power. Nowadays the Cloud is not used in the everyday routine of BioLabs, however, it has this potential, and we present the numerous benefits from applications in the modern BioLab. Additionally we provide a thorough bibliographical analysis of Cloud applications for research related to biology and biochemistry with emphasis on drug discovery, genomics and artificial intelligence. At the end of the chapter are presented future research directions according to the authors' views.

BACKGROUND

Selected basic knowledge background components are needed to approach the application of the Cloud on BigData produced by two medical and/or research laboratories related to medicine, namely the Medical Microbiology and the Clinical Biochemistry laboratories.

Medical Microbiology

Medical microbiology is a medicine branch related to the prevention, diagnosis and treatment of infectious diseases. Additionally, studies clinical applications of microbes for health improvement. Clinical microbiology is related to four kinds of microorganisms that may cause infectious diseases; bacteria, fungi, parasites and viruses.

Medical microbiology primarily focuses on the presence and growth of microbial infections in humans, their effects on the body and methods to treat these infections. Medical microbiologists primarily study:

1. Pathogen characteristics,
2. Transmission modes,
3. Growth mechanisms,
4. Infection mechanisms.

Via these studies a treatment can be proposed to physicians, therefore, medical microbiologists usually offer consulting services to physicians, by providing identification of pathogens and suggesting treatment options.

An additional branch of microbiology is related to the study of microbial pathology, mainly for non-pathogenic species in order to determine whether they can be used to develop antibiotics and other treatment methods. Finally, microbiology has other activities related to the population:

1. Identification of health risks related to the population.
2. Monitoring of the evolution of potentially virulent microbes.
3. Monitoring of the evolution of potentially resistant strains of microbes.
4. Education of the community.
5. Provisioning of assistance in the design of health practices.
6. Provisioning of assistance in the prevention and control of epidemics and outbreaks of diseases.

Clinical Biochemistry

Biochemistry is the science of chemistry applied in biology. Therefore, it is the study of chemical processes within and related to living organisms.

Related Content

A Survey on Research Initiatives for Healthcare Clouds

Rahul Ghosh, Ioannis Papapanagiotouand Keerthana Boloor (2014). *Cloud Computing Applications for Quality Health Care Delivery (pp. 1-18).*

www.irma-international.org/chapter/a-survey-on-research-initiatives-for-healthcare-clouds/110426

Edge Computing: A Review on Computation Offloading and Light Weight Virtualization for IoT Framework

Minal Parimalbhai Pateland Sanjay Chaudhary (2020). *International Journal of Fog Computing (pp. 64-74).*

www.irma-international.org/article/edge-computing/245710

FogLearn: Leveraging Fog-Based Machine Learning for Smart System Big Data Analytics

Rabindra K. Barik, Rojalina Priyadarshini, Harishchandra Dubey, Vinay Kumarand Kunal Mankodiya (2018). *International Journal of Fog Computing (pp. 15-34).*

www.irma-international.org/article/foglearn/198410

Fog Computing Architecture, Applications and Security Issues

Rahul Newareand Urmila Shrawankar (2020). *International Journal of Fog Computing (pp. 75-105).*

www.irma-international.org/article/fog-computing-architecture-applications-and-security-issues/245711

A Study on the Performance and Scalability of Apache Flink Over Hadoop MapReduce

Pankaj Latharand K. G. Srinivasa (2019). *International Journal of Fog Computing (pp. 61-73).*

www.irma-international.org/article/a-study-on-the-performance-and-scalability-of-apache-flink-over-hadoop-mapreduce/219361