

Quantum computing is a relatively recent field of study which, if successful, could potentially revolutionize the world of computation, with quantum computers being millions of times faster and able to process much more information in much shorter time than classical computers. For example computational power of quantum computers could lead to the necessity of inventing new methods of encryption because currently used ones could be easily brute-forced in a short time using a quantum computer. On the other hand quantum computers could be very powerful tools in scientific research, enabling to perform very complex simulations or analyze tremendous amounts of experimental data, for example from research centers like LHC in CERN, Geneva. The most promising way of making this technology available in the future for different companies and research centers is using cloud technologies.

One of the biggest companies which are currently working on this is IBM, an American technology company famous for many significant innovations in the field of computer science, like supercomputer Watson, available to process natural language, which won the quiz show Jeopardy! in 2011. In the field of quantum cloud computing currently IBM offers access via IBM Cloud to client devices consisting of 20 qubits, public devices consisting of 5-16 qubits and quantum simulator consisting of 32 qubits. They have built a user interface which allows users from around the world to connect to the quantum computer from their own devices like desktop computers and mobile phones and see how it works. For now these quantum computers are not big enough to perform any serious operations but IBM and other companies like Google and D-Wave are working on adding more qubits and improving the performance of these systems.

One of the many fields which can be revolutionized by the computational power of quantum computing is chemistry. Nowadays the way to inventing a new drug usually leads through many very complex computer simulations in order to find out how this substance will react with other chemical molecules in human body. Quantum computer would make it possible to perform these simulations in much shorter time. Quantum mechanics also plays an important role in chemical reactions at the atomic level but this behavior cannot be simulated on a classical computer and it is important to be able to model that if scientists want to deepen their knowledge of chemical reactions and be able to apply it in practice. One of such problems is for example the behavior of superconductors, which are also a component of a quantum computer. Currently scientists need to provide very low temperatures in order to preserve the properties of superconductors. Quantum computer simulations of their molecular structure and behavior could lead to a discovering the way of making them work even in much higher temperatures. Quantum simulations could also make it possible to determine more precisely the color of light given off by different types of molecules which could lead to gaining more knowledge about the content of faraway stars and galaxies.

Because quantum computers require very specific environment to work properly and it is hard and expensive to provide it, in the future the best option to make quantum computers available to the public is via cloud services. Quantum computers available for example as IaaS (Infrastructure as a Service) would give an access to its computational capabilities to different companies and research centers from different fields of science and business. Despite there is still a lot of work to do in order to obtain real quantum computing in a cloud, the future of this technology seems to be very promising.