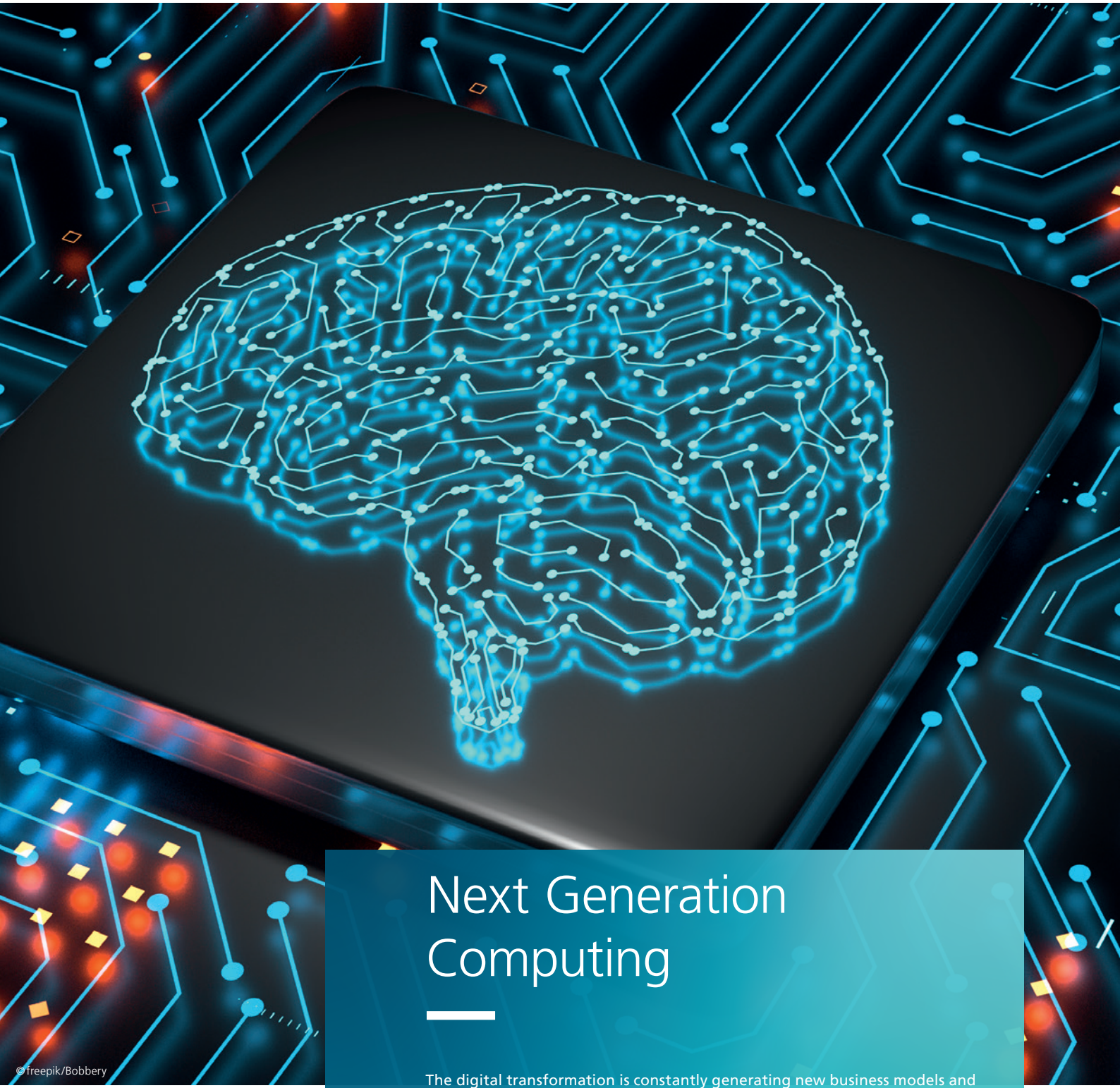

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Next Generation Computing

The digital transformation is constantly generating new business models and innovations. However, conventional computing technologies are reaching performance and energy efficiency limits: Time for Next Generation Computing! Time for a new hybrid computing generation! Fraunhofer is driving the development of hardware and technologies for the next generation of computing and is setting priorities in high efficiency trusted computing, neuromorphic computing and quantum computing. The goal is to develop trustworthy, highly perfomant and efficient hardware and software solutions.

Next Generation Computing is Based on Three Pillars

Dr. Jens Krüger from our "High Performance Computing" department is a Fraunhofer consultant for the strategic research field "Next Generation Computing". He ventures a look into the future and describes which computing technologies will shape the way we work and perhaps even our everyday lives.

The next generation of computing will be diverse. It stands on three pillars: the first pillar is based on traditional architectures as we know them today, but specialized. The second pillar represents neuromorphic technologies, which function similar to our brain, and the third pillar is quantum computers. Together with IBM, the Fraunhofer-Gesellschaft has been operating the IBM System One quantum computer near Stuttgart since June 2021.

The cool beauty of quantum computing: The System One from IBM is the fastest quantum computer in Europe.

What are the distinguishing features of high efficiency trusted computing?

The core is based on highly efficient trusted microelectronics. On the one hand microelectronics that are protected against hacker attacks on infrastructures and prevent the decryption of data communications on the other hand architectures that are designed to be very efficient. Such types of microprocessors are also to be developed in Europe. One example is EPI, the European Processor Initiative, in which 28 partners from ten European countries are jointly developing the high-performance computing processors and accelerator units. E.g. the Stencil and Tensor Accelerator (STX) is designed to support scientific computing applications – such as weather forecasting – and data analysis in an highly efficient way and involves the accelerator architecture and software ecosystem. We are focusing on the use of European technologies and are aiming for an energy-efficient processor technology with application in a European pre-exascale and exascale system.

What challenges can we meet with the next computer generation?

Digitization presents us with major challenges in the areas of health, mobility and the energy transition – continuously more data must be processed at ever increasing efficiency. One solution is neuromorphic computing, in which computers imitate the human brain. This is extremely efficient in processing information and very good at pattern recognition; at the same time, it is also extremely energy-efficient. We want to mimic this functionality of the brain by processing data in a network of neurons and synapses, rather than data transport from memory to the processing unit and specific instructions. A major advantage is the minimal energy required, because only the neurons of a network that are actually needed are activated.

More information at www.itwm.fraunhofer.de/EPI_en

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