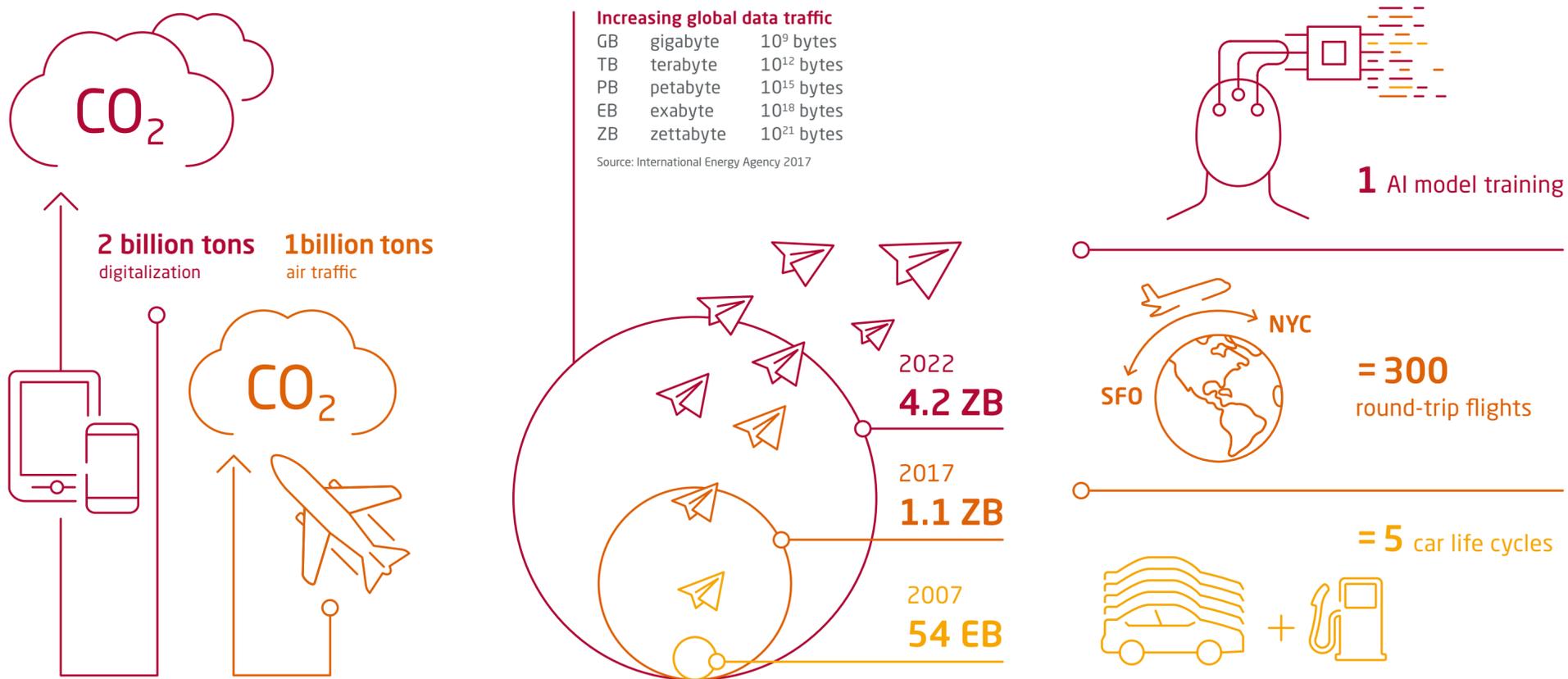


# clean-IT Initiative

## Towards Sustainable Digital Technologies

Artificial intelligence, ubiquitous data exchange, big data analysis and blockchain - digital transformation permeates our everyday lives around the world and is the key to solving global human challenges, such as climate change, poverty and economic prosperity for all. However, is digitalization ecologically sustainable? Currently, the answer is "no" - but this needs to change, and the sooner the better!

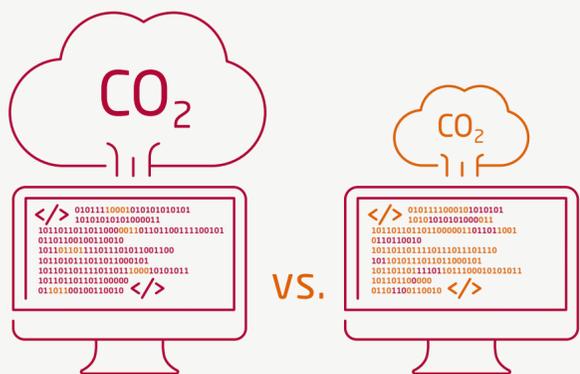
### Why we need clean-IT: Rapidly increasing energy consumption



**Emissions**  
 CO<sub>2</sub> emissions of digitalization are twice as high as global air traffic  
 Source: Air Transport Action Group 2019

**Artificial intelligence emissions**  
 Training a modern AI model can use up as much carbon as 300 round-trip flights from SFO-NYC or the life cycle of 5 cars incl. fuel.  
 Source: Strubell et al. 2019

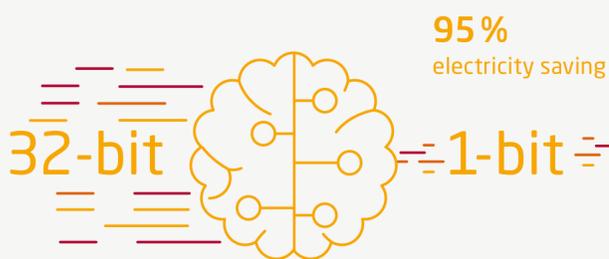
### How clean-IT works



To solve the paradox of more from less, the principle of "Sustainability by Design" needs to become the very foundation of software development. Often unnecessarily complicated or wasteful IT systems design causes higher energy consumption compared to algorithmic setups that are more efficient. Innovative IT architectures can achieve the same/slightly lower precision or data throughput, while saving enormous amounts of energy. Algorithmic efficiency therefore needs to become a leading paradigm of software development. We call this approach **clean-IT**.

### Examples of clean-IT: Binary Neural Networks

While the best AI systems train neural networks based on 32-bit algorithms, the procedure can also be carried out with "binary neural networks" (1-bit algorithm). This drastically reduces the effort in the individual calculation steps and immediately leads to energy savings by a factor of 20. Although binary neural networks are currently about 5% less accurate than those of AI systems of global players, the reduction can save 95% electricity usage. With AI applications being used millions of times a day, total emissions can be decreased significantly.



### Examples of clean-IT: Energy-Aware Computing

Next-generation data centers are embracing an increasingly diverse landscape of accelerators and hardware architectures, each offering advantages for certain algorithm classes or application domains. Unfortunately, today's software widely ignores this degree of heterogeneity. By executing workloads on the best-suited hardware, power efficiency can be improved significantly, e.g. by a factor of 10 for weather simulation models using FPGA accelerators instead of general-purpose processors.

