

Taming Dr. Frankenstein: Designing Distributed Systems

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Information technology moves rapidly to an increasingly decentralized and collaborative environment (the Cloud) with rich interfaces to the physical world (the Internet of Things). In particular, it has been predicted that by 2020 thousands of devices per person will be available. These devices will make it possible to make the computing infrastructure invisible to humans and to support societal scale applications that are unthinkable today. However, even today, we are facing a number of severe challenges in designing applications that should be monitored carefully with respect to security and privacy concerns.

Design of complex distributed system is essentially about connections: Connection of concepts, Connection of objects, Connection of teams. Products of the future will be connected across physical and virtual domains. Connections can produce systems that offer more than the sum of the components but they can also lead to systems that are less powerful than the sum of the components or that are so compromised by their interactions that they do not work at all. And this situation is getting worse: a nightmare waiting to occur! An efficient management of interactions among deployed parts of a larger system requires principles that are common to the design methods developed at the bleeding edge of technology. I will examine the evolution of design principles and of multiscale systems. I will point to a number of exciting fields such as energy efficiency, synthetic biology, aircraft and cars where advances are constantly made towards the mastering of distributed system design.