

Preface

The research projects of the Trusted Cloud Initiative of the Federal Ministry for Economic Affairs and Energy are developing novel cloud services and making them, as well as already existing services, usable for trustable IT applications. Cloud services have a number of advantages over in-house services, starting with cost efficiency and flexible payment models, where customers only pay for resources and services they actually use. Combined with the elasticity of service provision, that is the dynamic adaptation to seasonal or task-dependent resource demands of a service's operation, it makes Cloud Computing an attractive model for service provisioning on many layers (as application platform, programming model, or for domain-specific services).

However, the user gives up some control over the operation of the IT services to the service provider. This particularly concerns non-functional aspects of service provision, including quality attributes that impact the trustworthiness of the service. However, since the platform provider, due to economy of scale, can address these aspects more professionally, the service is expected to operate at a higher level of quality and under more robust security standards. Service-level agreements specify the qualities promised by the service provider, yet this does not solve the general problem that the service provider has to be fundamentally trusted. If the user does not or cannot grant this trust, Cloud Computing is not an option and its benefits not available.

The projects of the Trusted Cloud Technology Programme address this issue. The research and development conducted in groups of research institutes and enterprises aim at making Cloud Computing practical for trustworthy IT applications. This book documents the progress and results of these programmes and their critical discussion during a workshop at the Forschungszentrum Informatik (FZI) on the 10th of July 2013 in Karlsruhe which was organized by researches from the Karlsruhe Institute for Technology (KIT), the RWTH Aachen University, and the Technische Universität München. This workshop and the book at hand are a platform for presenting the scientific results of these projects and focus less on the business-related aspects. Nevertheless, the discussions have shown that business models, legislative circumstances, technical possibilities, and realizable security are tightly entangled and thus

have to be addressed jointly. This way, legislative requirements may be reflected in the Cloud's physical properties, for instance by a "private cloud" distribution model, or by ensuring that the service provider is operating in an appropriate legal sphere.

A holistic consideration of technological, societal and legal aspects is necessary to ensure the security of cloud services and the data they process, and to gain the trust of society and science in these services, especially in the light of the recent public discussions concerning the security of online data. Nevertheless, it is clear that the issue of security cannot be the responsibility of private enterprises alone. Small and medium enterprises, which are prevalent and of central importance in Germany, cannot stand up to foreign powers and intelligence agencies alone. The security of the Internet and the service that are based on has to be a national concern, if not a European one, in order to compete, and in some areas to catch up, in the marketplaces of the Internet. The Internet, including the operating systems of its nodes, its communication middleware and the application software, no longer is an infrastructure that is just relevant to IT enterprises. Instead, it impacts all areas of economy in Germany. The Trusted Cloud Programme is a highly relevant building block for innovation in the German economy.

Additional building blocks are the programmes Big Data of the BMWi and the Smart Data of the BMBF, both of which deal with the gathering of data over the Internet. We refer in this context to the Smart Data Manifesto, that originated as a key result of the discussions during the Trusted Cloud workshop.

Cloud components are moreover key parts of the cyber-physical infrastructure that will arise in the manufacturing, transportation, and service industry, as well as in the automation of mechanical activities through intelligent, cooperating robots, machines, and transporters. This change in our manufacturing business called "Industry 4.0" will be based on a strong cloud-based IT-infrastructure. It will need to be trustworthy to prevent massive economic damage beyond the IT industry. Reluctance in embracing this change will not be an option, since otherwise new business models will emerge outside of Germany instead of inside.

The research topics discussed in this book are diverse. They are in part fitted to the specific application domain of their projects, nevertheless, as it is typical in computer science, their fundamental technological solutions and platforms are portable to other domains.

The contributions in this book are categorized into the following topics:

- Security and Privacy
- Software Engineering and Quality
- Platforms and Middleware
- Social Aspects
- Business Models
- Standards

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to the Silicon Valley with Nadine Schön, MdB and Jennifer Welp. We especially thank Matthias Huber, Antonio Navarro Perez, and Jan Wollersheim that helped to organize the workshop and put the book together.

We hope that the book will inspire you to further scientific research or to use the results for the implementation of trustworthy cloud services. This would achieve one goal of the workshop and this book, to distribute these results to a broader audience and to applications beyond the scope of the Trusted Cloud projects.

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