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The IEC 62559-2 Use
Case Template and the
SGAM Applied in Various
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*If I have seen further it is only by standing on
the shoulders of giants.*

Sir Isaac Newton

Foreword

Recently, the development of systems and components has become more complex because systems from various domains are no longer kind of monolithic, but are more and more connected to other local ones or systems via internet-based communication. This leads to the fact that more and more interfaces between systems from different vendors arise. This raises the overall complexity of system integration from the requirements engineering point of view. The trend can be observed not only in domains like Smart Home, Smart Grid and Active Assisted Living, but also in industrial settings like factory automation. The development of system interfaces and the agreement on proper interoperability becomes more and more a cost driver in the development phase. With the upcoming convergence of various domains in the very scope of, e.g., the connection between Smart Home and Smart Grid, also different technical specifications and standards have to integrate in the system-of-systems environment. Individual domains have created individual data models, interfaces and pre-defined services based on common technologies like IP-based communications. But one particular challenge is to agree in a common way on the needed syntax and semantic of the data exchanged as well as the non-functional requirements, like timing, bandwidth or security. The design phase requirements process shall cover aspects, like technical standards and best practices on existing solutions.

Within the EU M/490 mandate, the German DKE has taken the initiative to bring forward a structured way of constructing and establishing sustainable processes for standardisation. One focus was to find a way of structuring requirements towards future standards in the scope of Smart Grids in an appropriate manner in order to facilitate the process for the heterogeneous stakeholders in the mandate. As one fundamental basis, the IntelliGrid Methodology for Developing Requirements for Energy Systems IEC/PAS 62559 was chosen as the methodological framework to create a process, a template and a repository to manage user requirements in the form of use cases from the various stakeholders in the mandate. Based on this work in the first phase of the mandate, a proper way to identify, in a holistic way, the requirements for future standards based on existing gaps for Smart Grids was

created. Over the course of the two phases of the mandate, the use case methodology and the corresponding Smart Grid Architecture Model (SGAM) from the reference architecture group of the mandate has proven to be best practices for a structured requirements engineering process as well as initial architecture drafting in the Smart Grid domain. As various FP7, H2020 and national projects gained experience and provided feedback, it became apparent that the use case methodology can also be of benefit in other domains. Within the IEC TC 8 at first, later at the IEC SyC groups, the use case template, its serialisation as well as the envisioned use cases have been standardised for system-of-systems in various domains.

Within this contribution, the authors outline the need for this structured approach, provide first feedback from projects, how it can be applied, and provide the needed basic knowledge to apply the process in the context of projects. It is a very timely contribution for upcoming projects which are looking to apply this emerging standard in their daily operations.

Frankfurt
August 2016

Jessica Fritz
German DKE
Project manager Industry 4.0

Preface

The standardisation for complex systems and their interfaces has become more and more important in the last years; particularly due to the rapid development in the information and communication technologies. This development influences several domains in society and industry, like the Active Assisted Living (AAL), Smart Home/Building, Smart Grid, Smart City, Industrie 4.0 as well as the maritime sector. For this purpose, a standardised and holistic approach of requirements engineering for Smart Grid projects based on work conducted within the M/490 standardisation mandate from the European Commission has been developed. Over the last few years, this method has been established rapidly in Europe as the basic building block in the very scope of requirements engineering in the utilities sector with a focus on the operational technology. Based on the outcomes of the energy sector, this approach developed through the support of OFFIS – Institute for Information Technology has been standardised as the IEC 62559 series which describes a use case methodology for the requirements engineering of complex systems.

The authors present a canonical, structured way for users to apply these methods from international standardisation alongside a use case management repository and a three-dimensional visualisation for (Smart Grid) architecture models, which are provided as open software tools. The implementation of these tools has been done in the German project UC4AAL funded by the German Federal Ministry for Economic Affairs and Energy under grant agreement No. 01FS13028, and the European project DISCERN – Distributed Intelligence for Cost-effective and Reliable Solutions funded by the European Union Seventh Framework Programme under grant agreement No. 308913.

This book provides an introduction to the very fundamentals of the IEC 62559 Use Case Methodology, how it is related to the Smart Grid Architecture Model (SGAM), and how a holistic view for both, requirements engineering and architecture, can be achieved. In addition, the application in various domains outside the Smart Grid is motivated as the method can be applied to critical infrastructures or cyber-physical systems (CPS), respective system-of-systems (SoS) like AAL and Industrie 4.0 domains as well.

The authors hope that this book is useful as introduction in the overall Use Case Methodology and the application of architecture models for reference designation as well as a Use Case Management Repository in many prospective projects.

Oldenburg
August 2016

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Acknowledgements

The methods presented in this book from the *SpringerBriefs* series are a brief summary of work by various stakeholders over the course of several years. The original need of this approach dates back to the EPRI IntelliGrid program, since 2015 called the Information and Communication Technology Program. The first work dates probably back as long as 2004 with the documentation of hundreds of use cases over the years and the issue has come into daily practice with the complexity arising from the so-called Smart Grid projects. Thanks to this, the template has been recognised as a potential contributor to lower the complexity of integration costs and requirements elicitation. Standing on the shoulder of giants, the authors therefore would like to thank the original EPRI team and its subcontractors for bringing up a meaningful way to structure use cases in the domain. In addition, we would like to thank various collaborators on the EU M/490 mandate, mainly Johannes Stein from German DKE to bring up the topic of having sustainable processes and tools in standardisation to the SG-CG group, the IEC TC 8 and, later, IEC SyC Smart Energy to keep on working on the specifications and making the PAS into a standard. Various persons have to be named in this context, mainly the following in no particular order: Ralph Sporer, Rolf Apel, Jörn Trefke, Rafael Santodomingo Berry, Cyrill Effantin, Eric Lambert, Arnaud Ulian, Jessica Fritz, Andre Göring and many more. In addition, the authors would like to thank their partners from the DISCERN, UC4AAL, IES Austria and ELECTRA projects for providing valuable feedback on the use of the overall tool-chain. We hope that the content presented in this book helps to facilitate the use of the methodology presented and spread its use around the community.