

# Preface

This first edition of Strategic Engineering for Cloud Computing and Big Data Analytics focuses on addressing numerous and complex, inter-related issues which are inherently linked to systems engineering, cloud computing and big data analytics. Individuals have consistently strived through engineering and technology to improve the environment on a global scale. With this ever-changing societal environment, there are far greater challenges which are required to address these phenomenal technological evolutionary demands.

The primary audience for the book is research students, industry experts and researchers in both industry and academia, masters level students, undergraduate students who are interested in the subject area with a view of gaining greater understanding and insight in the strategic implications of cloud computing in terms of big data analytics additionally managers wishing to gain a better understanding of introducing and implementing new improved technology concepts within their organisations. This book is particularly relevant for readers wishing to gain an insight into the overall constructs of systems engineering in line with the growing dimensions of cloud and big data analytics. It covers a wide range of theories, techniques, concepts, frameworks and applied case studies related to key strategic systems development, maintenance and modelling techniques.

The subject of strategic engineering is far too complex for such simple solutions and therefore the book provides a critical and reflective systems thinking approach. The book is particularly useful in illustrating an opulent foundation of materials which clearly and objectively draw upon a number of examples and real-world case studies in order to demonstrate the many key issues facing the ever-changing technological environment we live in today.

There are three key parts the book focuses on. Part I focuses on ‘Systems Lifecycle, Sustainability, Complexity, Safety and Security’; Part II focuses on ‘Systemic Modelling, Analysis and Design for Cloud Computing and Big Data Analytics’ and the final Part III focuses on ‘Cloud Services, Big Data Analytics and Business Process Modelling’, focusing on strategic approaches, with the onus on cloud services and big data analysis. The fundamental direction of systems engineering is unpacked around 12 chapters, which consider the process of evaluating

the outcomes of the key parts outlined above. The chapters provide significant level of depth for the reader with an emphasis of providing a clear understanding of system reliability, system design analysis, simulation modelling, network management protocols, and business intelligence tools for decision-making processes.

Finally we consider the current challenges in the multidisciplinary field of strategic engineering namely the future direction of systems engineering and the way it is shaped to match and complement the global environment, the changing societal needs, the challenges faced by business and the key policy drivers as well as the technologies that these future systems undertake. The technological advances aligned with the basic fundamental components, their subsystems and infrastructure will no doubt create and increasing leap into the future leading to erudite services and products. The book is structured in such a way so as the readers can follow the book, chapter by chapter sequentially or they can ‘dip into’ the book chapters as they please.

The main emphasis of the book is the fundamentals of strategic engineering by outlining the trends on the ground rules for through-life systems with a view of addressing simulation modelling in line with the systems engineering constructs. The book introduces 12 chapters and presents interesting and insightful discussions in terms of the growth in the area of cloud and big data analytics, dealing with phenomena such as software process simulation modelling for agile cloud, the impact of business intelligence on organisations and strategic approaches to cloud computing. The individual chapters included in each part of the book are briefly summarised.

Chapter “[Mathematical and Computational Modelling Frameworks for Integrated Sustainability Assessment \(ISA\)](#)” focuses on outlining generic mathematical and computational approaches to solving nonlinear dynamical behaviour of complex systems. The goal of the chapter is to explain the modelling and simulation of system’s responses experiencing interaction change or interruption (i.e., interactive disruption). Chapter “[Sustainable Maintenance Strategy Under Uncertainty in the Lifetime Distribution of Deteriorating Assets](#)” considers random variable model and stochastic Gamma process model as two well-known probabilistic models to present the uncertainty associated with the asset deterioration. Within Chapter “[A Novel Safety Metric  \$SM\_{EP}\$  for Performance Distribution Analysis in Software System](#)” the focus is primarily on safety attributes becoming an essential practice towards the safety critical software system (SCSS) development. Chapter “[Prior Elicitation and Evaluation of Imprecise Judgements for Bayesian Analysis of System Reliability](#)” examines suitable ways of modelling the imprecision in the expert’s probability assessments. Chapter “[Early Detection of Software Reliability: A Design Analysis](#)” takes the approach of design analysis for early detection of software reliability. Chapter “[Using System Dynamics for Agile Cloud Systems Simulation Modelling](#)” provides an in-depth background to cloud systems simulation modelling (CSSM) and its applicability in cloud software engineering—providing a case for the apt suitability of system dynamics in investigating cloud software projects. Chapter “[Software Process Simulation Modelling for Agile Cloud Software Development Projects: Techniques and Applications](#)” provides an

overview of software process simulation modelling and addresses current issues as well as the motivation for its being—particularly related to agile cloud software projects. This chapter also discusses the techniques of implementation, as well as applications in solving real-world problems. Chapter “[Adoption of a Legacy Network Management Protocol for Virtualisation](#)” discusses, with examples, how network management principles could be contextualised with virtualisation on the cloud. In particular, the discussion will be centred on the application of simple network management protocol (SNMP) for gathering behavioural statistics from each virtualised entity. Chapter “[Strategic Approaches to Cloud Computing](#)” outlines strategic approaches to cloud computing with the focus on cloud providing business benefits when implemented in a strategic manner. Chapter “[Cloud Security: A Security Management Perspective](#)” focuses on strategic level, security considerations related to moving to the cloud. Chapter “[An Overview of Cloud Forensics Strategy: Capabilities, Challenges and Opportunities](#)” outlines a model for cloud forensics, which can be viewed as a strategic approach used by other stakeholders in the field, e.g., the court of law. Chapter “[Business Intelligence Tools for Informed Decision-Making: An Overview](#)” explains business intelligence and analytics concepts as a means to manage vast amounts of data, within complex business environments.

The objective of the book is to increase the awareness at all levels of the changing and enhanced technological environments we are living and working in, and how this technology is creating major opportunities, limitations and risks. The book provides a conceptual foundation, moving to a variety of different aspects of strategic engineering modelling approaches with the view of challenges not only faced by organisations but additional technological challenges we are consistently moving towards. Within this area we reflect upon the developments in and approaches to strategic engineering in a thematic and conceptual manner.

We hope that by introducing material on topics such as through-life sustainable systems, cloud computing, systems engineering, big data analytics systems modelling, we have been able to build knowledge and understanding for the reader; after reading this book the reader should be equipped with a greater appreciation and understanding concepts and the key alignment of strategic engineering within real-world case examples. There is only a limited amount which can be contained in each chapter; all of the chapter topics warrant a book in themselves. The focus is clearly on presenting a high-level view of relevant issues. We would further like to take this opportunity to thank the contributors for preparing their manuscripts on time and to an extremely high standard.

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