



**BUILDING
DIGITAL**

**ECOSYSTEM
ARCHITECTURES**

A GUIDE TO ENTERPRISE
ARCHITECTING DIGITAL
TECHNOLOGIES IN THE
DIGITAL ENTERPRISE

MARK SKILTON



Building Digital Ecosystem Architectures



Digital technologies are revolutionizing the business world – challenging existing practices and enabling a new generation of business models.

Business in the Digital Economy is an accessible new series of books that tackles the business impacts of technology and the emerging digital economy. Aimed at non-technical, mid–senior executives and business managers, this series will help inform choices and guide decision-making on all major technological trends and their implications for business.

Series editors: Alan Brown and Mark Thompson

Available titles:

Predictive Analytics, Data Mining and Big Data

Steven Finlay
9781137379290

Building a Digital Enterprise

Mark Skilton
9781137477705

Series ISBN: 9781137395245

Building Digital Ecosystem Architectures

**A Guide to Enterprise Architecting
Digital Technologies in the Digital
Enterprise**

Mark Skilton

Professor of Practice, Warwick Business School, UK

palgrave
macmillan



© Mark Skilton 2016

© Foreword Allen Brown 2016

Softcover reprint of the hardcover 1st edition 2016 978-1-137-55410-9

All rights reserved. No reproduction, copy or transmission of this publication may be made without written permission.

No portion of this publication may be reproduced, copied or transmitted save with written permission or in accordance with the provisions of the Copyright, Designs and Patents Act 1988, or under the terms of any licence permitting limited copying issued by the Copyright Licensing Agency, Saffron House, 6–10 Kirby Street, London EC1N 8TS.

Any person who does any unauthorized act in relation to this publication may be liable to criminal prosecution and civil claims for damages.

The author has asserted his right to be identified as the author of this work in accordance with the Copyright, Designs and Patents Act 1988.

First published 2016 by
PALGRAVE MACMILLAN

Palgrave Macmillan in the UK is an imprint of Macmillan Publishers Limited, registered in England, company number 785998, of Houndmills, Basingstoke, Hampshire RG21 6XS.

Palgrave Macmillan in the US is a division of St Martin's Press LLC, 175 Fifth Avenue, New York, NY 10010.

Palgrave Macmillan is the global academic imprint of the above companies and has companies and representatives throughout the world.

Palgrave® and Macmillan® are registered trademarks in the United States, the United Kingdom, Europe and other countries.

ISBN 978-1-349-55526-0 ISBN 978-1-137-55412-3 (eBook)
DOI 10.1057/9781137554123

This book is printed on paper suitable for recycling and made from fully managed and sustained forest sources. Logging, pulping and manufacturing processes are expected to conform to the environmental regulations of the country of origin.

A catalogue record for this book is available from the British Library.

A catalog record for this book is available from the Library of Congress.

Typeset by MPS Limited, Chennai, India.

For Linda, Claire, Emma, and David.

Contents

List of Figures and Tables / x

Foreword / xiii

Preface / xvi

Acknowledgments / xviii

About the Author / xxi

Notes on Contributors / xxii

List of Abbreviations and Acronyms / xxiii

Book Structure / xxx

Disclaimer / xxxiii

Introduction / 1

Practitioners in the Digital Era / 1

Architecture Practice / 2

System of Systems Integration / 3

Value Network Analysis and Social Graphs / 6

Semantics and Contextualization / 7

Changing Architecting Paradigm / 8

New Worlds in Motion / 10

Crossing the Rubicon – the Digital Continuum / 10

New Architecture Practices for the Digital World / 14

Introduction Summary / 24

Part I Architecture in the Era of Digital Ecosystems

1 Trends of Technological Ecosystems / 27

Chapter Introduction / 27

The Connected Enterprise / 28

The Rise of Technological Ecosystems	31
Technology Ecosystem Viewpoint 1: The Information Ecosystems	32
Technology Ecosystem Viewpoint 2: Technology in the Supply Chain Network	33
Technology Ecosystem Viewpoint 3: Advanced Technology Transformation Engineering	39
Technology Ecosystem Viewpoint 4: Open and Proprietary Technology and Platforms	42
Technology Ecosystem Viewpoint 5: Technology in the Workplace	43
Technology Ecosystem Viewpoint 6: Enterprise Vendor Technologies	44
Technology Ecosystem Viewpoint 7: Privacy, Confidentiality, Security, and Trust	45
The Practitioners' Digital Enterprise Technology Constituency	48
Chapter Summary	49
2 Digital Workspace Concepts	50
Chapter Introduction	50
The Human–Machine Interface	51
The Semiotics Ladder	53
Contextualization of Objects, Places, and Actions	59
The Digital User Experience (UX) and Customer Experience (CX)	62
Enterprise Software Practice Evolution	68
Evolution of Software Techniques – Toward “Digital Convergence”	70
Fourth-Generation Software Developments and Techniques	72
Fifth-Generation Software Developments and Techniques	74
Data Analytical Software Developments and Techniques	76
Digital Workspaces	79
Digitization Transformation Viewpoint Perspectives	81
Spatial Field of Information View	83
Semantic Field of Information View	84
Temporal Information Field of View	86

Convergence of Digitization in Physical and Virtual Space and Time	87
Transformation of Physical Workplaces to Virtual Workspaces by Digitization	89
Definition of Digital Workspaces from an Ecosystem Perspective	89
Definition of Digital Workspaces from a Human Perspective	91
Design of Digital Workspaces	93
Digital Workspaces as Digital Platforms	97
The Next Technological Era	101
Chapter Summary	102

Part II Designing the Digital Enterprise

3 Design Practices in the Digital Enterprise	105
Chapter Introduction	105
Example of a Digital Business Model Using Digital Workspaces	105
Modeling Digital Solutions in Enterprise Architecture	113
Architecting a Digital Workspace Example	117
Example 1 – Digital Hospitality Enterprise Architecture Model	122
Example 2 – Digital Retail Enterprise Architecture Model	123
Example 3 – Connected Car Digital Enterprise Architecture Model	124
Design Practices in Digital Enterprise	126
Modular Scalable Multi-Sided Platforms	126
Competition Moving to Ecosystem Level	128
The Rise of Ecosystem Architecture	129
The Future of Intelligent Workspaces	131
Digital Workspaces Pattern Catalog Example	132
Conclusion	134
Chapter Summary	141

Notes	142
-------	-----

International Technical and Business Standards Bodies and Suggested Further Reading	149
---	-----

Index	150
-------	-----

List of Figures and Tables

／ Figures

- i.1 Early system of systems concepts ／ 4
- 1.1 Examples of technological ecosystems viewpoints ／ 32
- 1.2 The shift of time and space by advanced technology engineering transformations ／ 40
- 1.3 Advanced technology transformations changing workspace capabilities ／ 41
- 1.4 PCST model of digital privacy ／ 46
- 2.1 Human-machine boundaries ／ 52
- 2.2 Semiotics ladder ／ 54
- 2.3 Evolution of information theory ／ 58
- 2.4 Software and hardware development techniques ／ 72
- 2.5 Fields of view PEC – physical, extended, contextual – model ／ 80
- 2.6 Field of view of an STC – spatial, temporal, contextual – model ／ 82
- 2.7 Spatial views of view ／ 83
- 2.8 Spatial information field of view ／ 84
- 2.9 Physical data, metadata, and hyperdata ／ 85

- 2.10 Semantic information field of view / 85
- 2.11 The present now, pasts, and futures / 86
- 2.12 Temporal information field of view / 87
- 2.13 Convergence of digitization in physical and virtual space and time / 88
- 2.14 Digital workspace / 90
- 2.15 Definition of digital workspaces / 94
- 2.16 Digital workspaces as platforms / 98
- 3.1 Smart hospitality – digital experience strategies / 110
- 3.2 Smart hospitality – digital delivery strategies / 111
- 3.3 ArchiMate® notations symbol examples / 113
- 3.4 Technical reference model concept / 114
- 3.5 ArchiMate® example of the technical reference model for an application model / 115
- 3.6 Enterprise architecture basic framework / 116
- 3.7 Experience mediation role example / 117
- 3.8 Example of connected guest digital workspace / 118
- 3.9 Modular, scalable, generative digital workspace / 119
- 3.10 An eHotel digital enterprise architecture model example / 120
- 3.11 An eRetail digital enterprise architecture model example / 122
- 3.12 A connected car digital enterprise architecture example / 124
- 3.13 Modularity and platform as a core practice for digital enterprise architecture / 127
- 3.14 Competition has moved to the ecosystem level / 129
- 3.15 Ecosystem architecture continuum / 130
- 3.16 The role of clusters and the emergence of ecosystem architecture / 131
- 3.17 Transaction touchpoints to experience touchpoints / 135

- 3.18 Toward digital ecosystems / 136
- 3.19 Digital enterprise with PEC and STC views / 138
- 3.20 Designing digital workspaces that drive digital value / 140

Tables

- i.1 Network topologies / 12
- i.2 Spectrum frequency – device receiver and transmission network protocols / 12
- 1.1 Examples of information and physical domain ecosystem mappings / 34
- 1.2 Examples of physical to virtual supply chain processes / 37
- 1.3 Advanced technology engineering transformation / 41
- 2.1 What is the context of “a hot cup of coffee”? / 60
- 2.2 Space, time, context example definitions / 63
- 2.3 Digital knowledge platform examples / 99
- 2.4 Digital contextual augmentation platform examples / 99
- 2.5 Digital transit platform examples / 99
- 2.6 Digital personal/business community platform examples / 100
- 2.7 Digital room/facility platform examples / 100
- 2.8 Digital object platform examples / 101
- 3.1 Hospitality operational versus customer outcomes / 107
- 3.2 Example of digital workspaces patterns catalog / 133

Foreword

Over the past century, technology – primarily in the form of computing systems – has evolved at a pace never before seen in human history. These changes have not only made life simpler for most people, but have also brought great convenience and immediacy to everyday activities. One need only to consider our new-found dependence on smartphones – devices that barely existed before the iPhone was introduced less than ten years ago in 2007 – to realize just how rapidly technology is changing our lives.

The new digital landscape has also pervaded nearly every system and organization across the globe. Despite the simplicity digitalization has brought to business processes and structures, the technology systems themselves have become increasingly complex over time. This is particularly true in large enterprises, which now require entire buildings placed strategically across globe to maintain the company “infrastructure.”

To better manage these systems, enterprise architecture emerged over the past 30 years as a discipline and profession that provided a necessary bridge between the IT department and the business. It has been adopted by companies, partnerships, government departments and agencies, charities and non-profit organizations: in effect, every type of organization that exists.

Enterprise architecture addresses the complexity of information technology systems and the need to integrate new capabilities with the existing legacy in heterogeneous environments. Initially enterprise architecture was justified as a cost-saving tool. It soon moved to being recognized, not only

as a means to control cost but also to enable new capabilities. Now it is becoming a critical business discipline, alongside other essential business functions such as accounting, finance, legal, or marketing, no matter whether the business is a commercial organization, a government agency or, as in the case of The Open Group, a not-for-profit enterprise.

Every organization that exists today has become its own system with a mission (whether explicit or implicit), people, processes, technology and ecosystem of partners, each of which are constantly changing at an ever increasing pace and becoming more and more complex in their own right. As such, many enterprises today are being inundated with the digitization of their business models: products and services, processes, changing costs, revenue and profit models, new subscription and incremental models in capital expenditure and operating expenses, new operating value chains and shifting market position and channels. Boundaryless Information Flow™, the vision of The Open Group, conceived over a decade ago by our members, is even more of a business imperative today, from the macro-scale of connected markets and nations to the micro-economy of trading, social media and personalized mobile services and wearables.

That vision also recognized the need for information to be secure, reliable and timely. Today, new cyber threats and challenges, together with new opportunities for e-commerce have created the need for trade-offs in the flow of information among and between organizational systems, the need for new global standards, and the need to minimize regulation, which by definition is bound by geo-political constraints.

As the march toward digitization has gained momentum, some organizations have become trapped by their brand (how they are perceived), by their culture (how they think), by their processes (how they get things done), or by their technology (in both what they make and the tools they have) and have become the victims of significant shifts in their industry. These are the areas where enterprise architecture can help organizations adapt to this new landscape.

As with any discipline, enterprise architecture also must evolve to meet the needs of the digital economy. Like other professional disciplines, enterprise