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Reference Architecture for the Telecommunications Industry

Transformation of Strategy, Organization, Processes, Data, and Applications

Springer

Progress in IS

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∅ Springer

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Preface

The idea of writing this book came to us while we were together on one of our frequent international business trips in the Middle East. Through our role as consultants, we were involved in a broad variety of project engagements, proposal development activities, presentations, and publications related to the architectural transformation of telecommunications operators. In the last decade, we have supported more than 50 transformational projects in the telecommunications industry worldwide. Most of these dealt with the customization of reference solutions provided by the TM Forum and the alignment of those solutions across different parts of the company. This encouraged us to summarize our experiences in general recommendations and blueprints. Moreover, we have had the good fortune to discuss our viewpoints with executives as well as experts worldwide. We came to the conclusion that there is a significant and indeed increasing demand in this knowledge area for professionals, researchers, and students associated with the telecommunications industry. These facts and our well-founded scientific research experience, combined with practical knowledge from our project engagements across the globe, have motivated us to write this book together.

Preparing the concept of this book as well as the detailed elaboration of the content, while at the same time working as professional consultants and academics, has certainly demanded a lot from both of us. In addition, the fact that each of us has been working on different chapters and sections in different locations and time zones has led to several alignments and iterative updates to ensure the comprehensibility and the consistency of the contents throughout all chapters. In total, it has taken us almost two years to finalize this book.

Writing this book was only possible because of the comprehensive, ongoing support we have received from our project clients and colleagues. Being part of the innovative and international environment at the management consultancy, Detecon International GmbH was one of the lucky circumstances that resulted in the opportunity to summarize our experiences in this book. We would like to express our special appreciation to Issa Nasser Oesterreich and Dr. Kai Grunert, who always supported us and gave us the freedom to realize our ideas on projects worldwide. Furthermore, we had the great pleasure to work with teams of inspiring and

knowledgeable colleagues. We were always supported by our colleagues from the MENA office, the International Telco Cluster, and our eTOM knowledge initiative. Whereas it is impossible to list all of their names here, we would like to thank each of them personally. Without the TM Forum, our book would not have been possible, so our sincere thanks go to the whole TM Forum team and the eTOM working group. We would also like to thank our editor Christian Rauscher, who was a great help during the whole publication process, and Patricia Joliet for her excellent work in proofreading our manuscript.

Writing such a book alongside the daily work responsibilities has been a challenge that we were only able to meet through the continuous encouragement of our families and friends. We would like to express our deep gratitude to all of them and especially to Nadine Schultes, Cecilia Carvajal, and Dr. Andreas Dietze.

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Abbreviations

3G	Third generation (of mobile network technologies)
4G	Fourth generation (of mobile network technologies)
ABE	Aggregated Business Entity
ADM	Architecture Development Method (as a part of TOGAF)
ANSI	American National Standards Institute
ARPU	Average Revenue per User
B2B	Business-to-Business
B2B2C	Business-to-Business-to-Consumer
BPM	Business Process Management
BPMN	Business Process Model and Notation
BSS	Business Support Systems
CCAO	Chief Corporate Affairs Officer
CCO	Chief Commercial Officer
CCTA	Central Computing and Telecommunications Agency
CEM	Customer Experience Management
CEO	Chief Executive Officer
CFO	Chief Financial Officer
CHRO	Chief Human Resources Officer
CIM	Computer-Integrated Manufacturing
CIO	Chief Information Officer
CLCO	Chief Legal and Compliance Officer
CMO	Chief Marketing Officer
CNBO	Chief New Business Officer
COO	Chief Operating Officer
CPO	Chief Procurement Officer
CRM	Customer Relationship Management
CSO	Chief Strategy Officer
CTO	Chief Technology Officer
E2AF	Extended Enterprise Architecture Framework
EAF	Enterprise Architecture Framework

EAM	Enterprise Architecture Management
EPC	Event-driven Process Chain
ERM	Entity Relationship Model
eTOM	enhanced Telecom Operations Map
FEAF	Federal Enterprise Architecture Framework
FTTH	Fiber-to-the-Home
GCC	Gulf Cooperation Council
HIS	Hospital Information Systems
HR	Human Resource (Management)
HTML	Hypertext Markup Language
IaaS	Infrastructure as a Service
IAF	Integrated Architecture Framework
ICT	Information and Communication Technology
IEEE	Institute of Electrical and Electronics Engineers
IFEAD	Institute for Enterprise Architecture Developments
IPTV	Internet Protocol Television
ISP	Internet Service Provider
IT	Information Technology
ITIL	Information Technology Infrastructure Library
ITU	International Telecommunication Union
KPI	Key Performance Indicator
LTE	Long-Term Evolution
M2M	Machine-to-Machine
NGN	Next-Generation Network
NIST	National Institute of Standards and Technology
NOC	Network Operations Center
OECD	Organization for Economic Cooperation and Development
OSI	Open Systems Interconnection
OSS	Operations Support Systems
OTT	Over-The-Top
PaaS	Platform as a Service
PMI	Program Management Institute *or* Post Merger Integration
PRINCE2	PRojects In Controlled Environments, version 2
QoS	Quality of Service
RfP	Request for Proposal
RLC/MAC	Radio Link Control/Medium Access Control
SaaS	Software as a Service
S-BPM	Subject-oriented Business Process Management
SID	Shared Information/Data Model
SIM	Subscriber Identity Module
SIP	Strategy, Infrastructure, and Products (as a part of eTOM)
SME	Small- and Medium-sized Enterprises/Small and Medium Enterprise
SMS	Short Message Service
SOA	Service-Oriented Architecture
TAFIM	Technical Architecture Framework for Information Management

TAM	Telecom Applications Map
TCP/IP	Transmission Control Protocol/Internet Protocol
TEAF	Treasury Enterprise Architecture Framework
TNA	Technology Neutral Architecture
TOGAF	The Open Group Architecture Framework
TV	Television
UML	Unified Modeling Language
VoIP	Voice over Internet Protocol

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Chapter 1
Addressing the Transformational Needs of Telecommunications Operators

Abstract The telecommunications industry has changed tremendously during the last decades. Challenges of today's telecommunications operators are, for example, enhanced customer orientation and product innovation combined with cost savings as well as shorter lead times. In many cases, this leads to continuous improvement and restructuring initiatives. Process standardization, automation through new software systems, outsourcing of support activities, and roll-out of new network technologies are just some of the typical topics of these initiatives. In this context, an aligned transformation of organization, processes, applications, data, and network technologies is a key success factor. The overall structure of such transformations is supported by general enterprise architecture methods. From a topical perspective, industry-specific reference solutions are proposed by well-recognized industry organizations, such as the TM Forum. This book explains the whole architectural transformation customized to fit the specific challenges of telecommunications operators. All phases are described, from the planning and set-up to the implementation. While this chapter provides an introduction and summary, in subsequent chapters the following details are discussed: Specifics of the telecommunications industry are described in Chap. 2, methodical principals are explained in Chap. 3, a concrete recommendation for the architecture solution is proposed in Chap. 4, and the planning and implementation are discussed in Chap. 5. This book gives the latest insights into the standard development, shows lessons learned from numerous international projects, and presents well-founded research results. Telecommunication practitioners, enterprise architects, project managers, researchers, and students alike benefit from numerous examples and illustrations.

The telecommunications industry has changed tremendously during the last decades. Challenges of today's telecommunications operators are, for example, enhanced customer orientation and product innovation combined with cost savings as well as shorter lead times. In many cases, this leads to continuous improvement and restructuring initiatives. Process standardization, automation through new software systems, outsourcing of support activities, and roll-out of new network technologies are just some of the typical topics of these initiatives. While some

telecommunications operators are able to plan, design, and implement these changes successfully, others become lost in a labyrinth of unaligned activities. A major challenge is to understand the interrelation between those different topics and to design, plan, and implement a well-defined target picture for the whole enterprise. A typical situation in practice is that, in parallel, the IT department plans the outsourcing of IT services to save operational costs, the marketing department plans the launch of a new IPTV offer to increase revenues, and the technology department plans the harmonization of their production systems. In the end, all these different initiatives might result in minor, local improvements that are paid dearly with various conflicts and difficulties from a cross-functional perspective.

An aligned transformation of organization, processes, applications, and network technologies is a key success factor for today's telecommunications operators. The overall structure of such transformations is supported by general enterprise architecture methods. From a topical perspective, the International Telecommunication Union (ITU) and the TM Forum provide reference solutions, such as the *enhanced Telecom Operations Map* (eTOM) for processes and the *Telecom Applications Map* (TAM) for applications. These reference models are well recognized by the whole value chain of the telecommunications industry and can be seen as de facto standard. However, to gain the full benefits of these standards, a structured approach that shows how to use them in a practical context is essential.

From a practical perspective, the content of this book is particularly beneficial for people working in the telecommunications industry including:

- general top managers;
- managers of IT, network or technology departments;
- process/quality/architecture management departments;
- program management departments;
- project managers and team members of transformation projects;
- consulting companies, freelancers, and system integrators.

In addition, researchers and students receive detailed industry-specific insights into the context of information systems.

1.1   What Is the Structure of This Book?

This book explains the whole architectural transformation customized to fit the specific challenges of telecommunications operators. All phases are described, from the planning and set-up to the implementation (cf. Fig. 1.1). The specifics of the telecommunications industry are described in Chap. 1, and the methodical principals are explained in Chap. 3. Based on these two fundamental topics, a concrete recommendation for the architecture solution is proposed in Chap. 4. This architecture solution combines the general structure of enterprise architectures and reference standards in the telecommunications industry and offers a reference for a
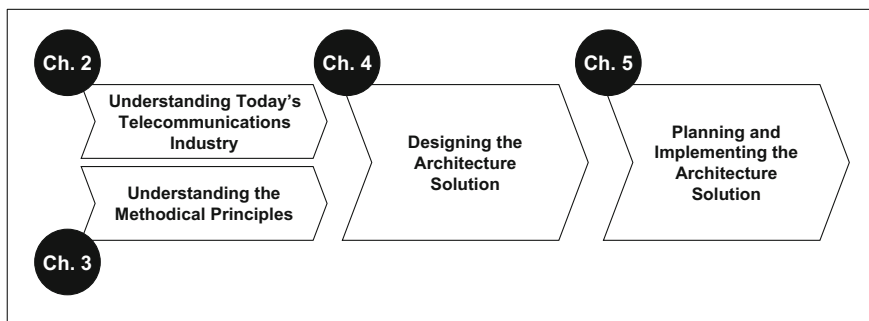
Fig. 1.1 Chapters and their interrelation

concrete solution design. In Chap. 5, the planning and implementation are dis-
cussed, using various projects as examples. This book comprises the overarching
view of enterprise architecture concepts together with the specific industry stan-
dards. It gives the latest insights into the standard development, shows lessons
learned from numerous international projects, and presents well-founded research
results in enterprise architecture management and reference modeling.
Telecommunication practitioners, enterprise architects and project managers alike
benefit from numerous examples and illustrations.

1.2   What Are the Major Findings of This Book?

Understanding today's telecommunications industry is a prerequisite for a suc-
cessful solution design and implementation. The tremendous changes of the
industry during the last decades have completely altered their rules and structures.
In the past, traditional—mainly government-owned—telecommunications operators
were responsible for the technical realization of fixed-line and mobile radio com-
munications. Their business model was based on long-term infrastructure invest-
ments that were financed through usage-based connection fees. Today competitors
of traditional operators do not necessarily require their own network infrastructure
—such as, for example, Over-The-Top (OTT) Providers. Increasingly, the technical
connection is becoming a commodity. Innovative applications, convergent services,
and dedicated customer orientation are today's success factors. However, increasing
data volumes and mobile usage still requires ongoing modernization of network
technologies. Figure 1.2 shows the worldwide development of telecommunications
subscriptions. During the last 10 years, fixed lines have been in constant decline,
while mobile-cellular and especially mobile broadband have increased
tremendously.
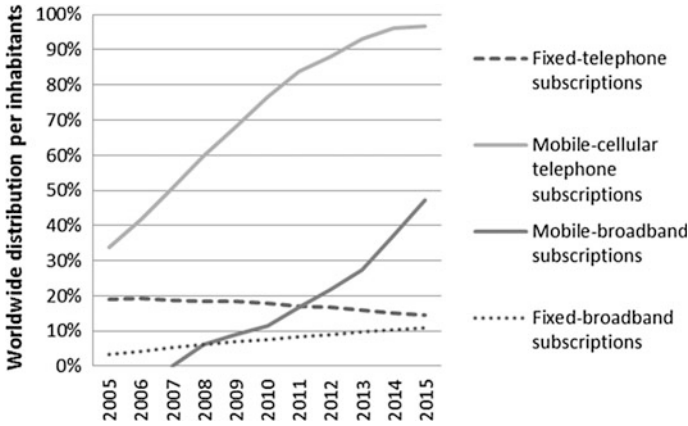
Fig. 1.2 Development of telecommunications subscriptions[1]

Due to the increasing competition, price decreases can be observed (ITU 2015b, p. 5; Plunkett 2014, p. 8). As a result, the revenue growth rates are low: for example, the Telecommunication Industry Association observed an average growth of 6 % in telecommunications spending between 2010 and 2015 Telecommunications Industry Association (2015). A major challenge for telecommunications operators is the combination of continuous innovation requirements with a stagnating market and changing value chains.

Understanding the methodical principles is indispensable for the successful adaptation of structures, processes, and applications to the changed industry conditions. In most cases, those adjustments are related to the various different parts of a telecommunications operator. The planning, design, and realization of those changes are a complex endeavor which, in most situations, takes several years, involves huge project teams, and impacts major parts of the enterprise. Without clear structures and guidelines, the risk of inconsistent and singular solutions is high. The overriding challenge is to understand the interrelations between the different enterprise parts and take decisions that are beneficial from the overall enterprise perspective. The general methodical foundation of the solution design is related to information systems modeling. In this context, information systems are a complex construct comprised of employees, their organizational responsibilities, their activities that create the enterprise's outcome, as well as applications that support and automate activities. Enterprise architectures provide a general structure to plan, design, and implement those complex solutions. Content-wise, reference

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[1]Own illustration, data is based on ITU (2015a). The distribution per inhabitants is a theoretical figure based on the total number of subscriptions and the world population. It does not provide penetration rate—i.e., through the high mobile penetration in developed countries, one mobile subscriber often has several subscriptions. The number of worldwide mobile-cellular telephone subscriptions in comparison to the world population has almost reached the 100 % mark.

models are used as recommendations. In the telecommunications industry, the TM Forum offers well-accepted reference models for processes, data, and applications. From the dynamic perspective, concepts of enterprise architecture management and enterprise transformation support the planning and implementation.

Designing the architecture solution combines the methodical principles in an architectural construct that offers clear recommendations for the specific challenges facing today's telecommunications operators. First, the relevant elements are identified and arranged in an architecture structure for organization, processes, data, and applications. As an additional structural element, five industry-specific architecture domains are proposed. These architecture domains provide an overall structure of telecommunications operators. The customer-centric domain covers all architecture elements related to direct customer interactions. All technical specifics are encapsulated in the technology domain. The product domain includes the planning, development, and roll-out of new products. Both the product and the
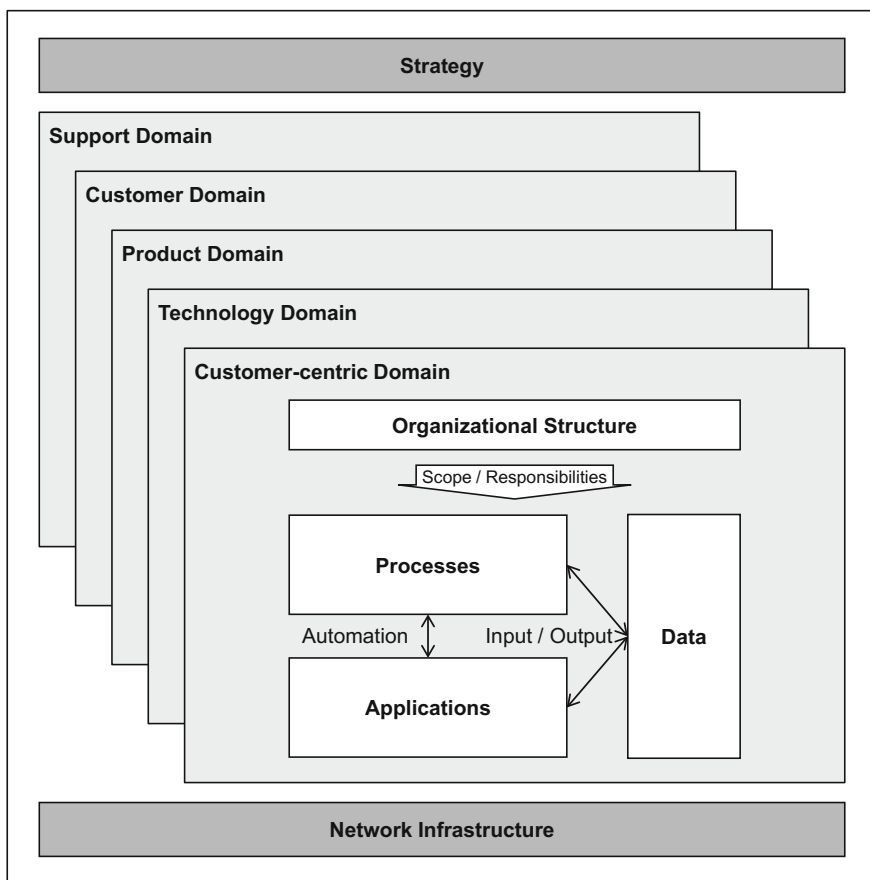

Fig. 1.3 Overall structure of the reference architecture

technology domain prepare the prerequisites to fulfill customer requests in the customer-centric domain. Further support activities are included in the customer domain and enterprise support domain. For each of these domains, concrete reference solutions for organization, processes, data, and applications are described (cf. Fig. 1.3). These reference solutions combine the industry-specific TM Forum reference models and provide a detailed blueprint for the transformational needs of telecommunications operators. The reference architecture includes a hierarchical decomposition and interrelations between the different elements.

In the following, an exemplary description of the different elements of the reference architecture proposed in this book is given (cf. Fig. 1.4). The customer-centric domain contains seven reference process flows defining all interactions with a customer from an end-to-end perspective. The Request-to-Answer process is one of these reference process flows. It deals with answering all types of customer requests. The process can be divided into the following activities: customer contact management, request specification, and the handling of the request according to the request type (cf. upper part of Fig. 1.4).

The responsibilities for management and execution of these activities are defined by the organizational structure. Parameters for structuring those responsibilities are contact channel, customer type, product type, and geographical structure. Typical contact channels for consumer customers are call center, shops, internet, and indirect sales. A possible organizational structure is a consumer sales and customer service unit that contains departments for each contact channel (cf. middle part of Fig. 1.4). From an organizational perspective, a differentiation between contact channels is reasonable. However, from the process perspective, standardization between those contact channels is recommended. The data elements required in the Request-to-Answer process are mainly customers and products (cf. bottom left of Fig. 1.4). The Request-to-Answer process is mapped to various application areas, such as customer information management, customer order management, and customer self-management (cf. bottom right of Fig. 1.4).

Planning and implementing the architecture solution is essential to benefit from the solution design. From a dynamic perspective the architectural implementation is a transformation from the current state of the enterprise to a targeted state that is defined by the solution design. In most cases, the entire design and implementation are conducted in a cross-functional project. With respect to the duration and persons involved, such a project can be seen as complex endeavor. Various interrelations between the architectural elements, conflicts of objective between different organizational entities, and changing external or internal factors require careful consideration. For planning the tasks from the set-up to design and implementation, an Architecture Solution Map is proposed. It consists of eight major tasks (cf. Fig. 1.5).

At the beginning, the architecture diagnostics provides an analysis of the current situation as basis for a first goal definition. The strategic alignment ensures that the transformational goals are consistent with the overall corporate strategy. The definition of a high-level architecture framework could be a customized version of the reference architecture proposed in this book. Typically a cross-functional
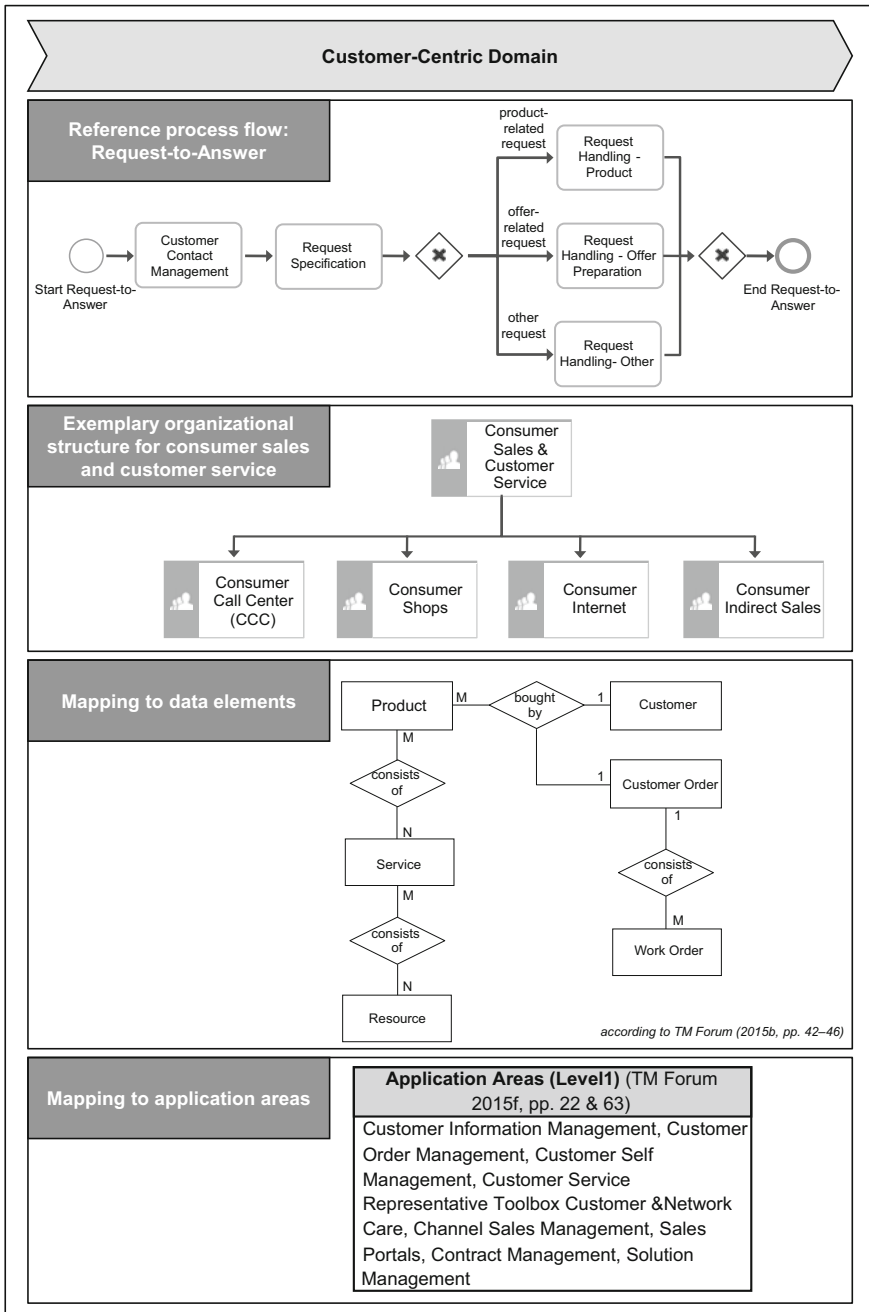
Fig. 1.4 Exemplary detailing of reference architecture