From Enterprise Architecture to IT Governance

Elements of Effective IT Management
Preface

This book is addressed to IT decision makers who face the task of securing and exploiting the overall potential presented by their information systems despite budget constraints. It concerns itself with the task of establishing IT governance processes that ensure comprehensive control as one moves from strategic planning to operative implementation. This task demands orientation and transparency, i.e. a management information system for the CIO.

Such a system is available in the form of enterprise architecture (EA). EA delivers clear answers, it reveals deficiencies, illustrates the complex interaction of business processes, applications and infrastructure, and provides a foundation for the kinds of analyses that give us the right information and enable genuine IT governance.

The term IT governance is more than a mere buzzword. As an IT executive, one may sense that one’s information systems are out of kilter and that it will be necessary to take action to avoid being treated as if one were a magic orange that continues to yield juice no matter how often it is squeezed. While governance (or control) sounds like the right response, it is not clear where we should begin. Do we know exactly where the gears need lubrication? Do we know where the rust has taken hold?

The reports from the IT jungle are full of examples of technological frivolity, heterogeneous infrastructure environments, servers running below capacity, redundant hardware, and superfluous development tools. My response: first optimize, then synchronize. The slow and rusty IT machine cannot keep pace with business developments. Their clock speeds are too disparate. Attempts to establish alignment and synchronization are doomed to fail.

Enterprise architecture can illuminate the darkness and create transparency. If we wish to extricate ourselves from the vicious circle of the magic orange, achieve business alignment, demon-

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1 Stephen Norman, CIO of Merrill Lynch, used this metaphor at the MIT CIO Summit on May 22, 2003 to characterize the situation of many IT divisions that are confronted with ever new cost cutting initiatives.
strate the value of IT for our business objectives and increase asset value, then we will need to obtain the instruments of analysis that convey light and transparency. It is, after all, difficult to navigate in the dark!

This book includes a message for all of those who are faced by these challenges. This message is probably best expressed by an African saying that is quoted by Thomas L. Friedman in his best-seller *The World Is Flat* (FRI2005):

> Every morning in Africa, a gazelle wakes up.  
> It knows it must run faster than the fastest lion or it will be killed.  
> Every morning a lion wakes up.  
> It knows it must outrun the slowest gazelle or it will starve to death.  
> It doesn’t matter whether you are a lion or a gazelle.  
> When the sun comes up, you better start running.

If optimizing and managing IT is your task, then this book will help you to find the best possible starting point for the race. It will help you to establish an information and management system for your IT that creates transparency and supports you when it comes to facing the latest requirements your information systems are expected to meet.

This book was conceived to serve as a basis for orientation and decision making, as a helpful *management guide to establishing enterprise architecture and architecture management* in your organization. To this end, I offer a brief sketch of the EA essentials. What is it? What does it look like? What does it offer? What does it cost? The discussion here assumes that IT architecture is both useful and stable. Useful means doing the right things right. Stability means security.

Would you rather let yourself be controlled (like a magic orange) or do the controlling yourself? If you prefer to take the helm, then this book will give you an overview of the available navigational instruments. But there is also something for those who prefer to risk the fate of the orange that is perceived to be a magic orange, for EA will help you to get the last drop of juice – to consolidate, to homogenize, to increase efficiency and to analyze cost drivers.

Many individuals have made a contribution to the creation of this book. I would like to thank the participants of our architecture
management circle² here in Germany and my colleagues around the world in the OpenGroup's Architecture Forum for their many insights and thought-provoking suggestions. This book would never have come into being without the patience and loving support of my family.

Braunschweig, September 2005

Klaus D. Niemann

² More on this series of events is available on the website for this book: www.unternehmensarchitektur.de
Table of Contents

1 Introduction: When Things Just Work ................................................................. 1
  1.1 Overview: The Essence in a Nutshell ............................................................... 2
  1.2 Orientation: Notes for the Reader ................................................................. 11

2 Foundations: Finding the Starting Point ............................................................. 13
  2.1 Enterprise Architecture (EA) ......................................................................... 13
  2.2 IT Architecture ............................................................................................ 21
  2.3 Architecture Management ............................................................................ 22
  2.4 The IT Architect ......................................................................................... 24
  2.5 Corporate Governance ................................................................................ 26
  2.6 IT Governance ............................................................................................. 27
  2.7 Enterprise Architecture as a Basis for IT Governance ............................... 29
  2.8 Establishing and Using Enterprise Architecture ......................................... 36
  2.9 Enterprise Architecture in an IT Management Framework ....................... 38

3 Goals: Doing the Right Things Right ................................................................. 43
  3.1 The Potential Benefits of Enterprise Architecture ....................................... 44
  3.2 Optimizing IT Efficiency ............................................................................. 49
  3.3 Optimizing IT Effectivity ............................................................................. 57
  3.4 Optimizing IT Security ................................................................................ 66
  3.5 The Goal: Illuminate the Dark .................................................................... 72
4 Documentation: Structuring Enterprise Architecture ...........................................75
  4.1 Anatomy of an Enterprise Architecture Model.............................................76
  4.2 Business Architecture ..................................................................................87
  4.3 Software Architecture ...................................................................................94
  4.4 Systems Architecture ....................................................................................107
  4.5 Applications Environment .............................................................................116

5 Analysis: Evaluating Enterprise Architecture..................................................123
  5.1 Overview of Analysis Procedures .................................................................123
  5.2 Analysis of Dependencies .............................................................................129
  5.3 Coverage Analysis .........................................................................................130
  5.4 Analysis of the Interfaces ..............................................................................131
  5.5 Analysis of Heterogeneity ..............................................................................133
  5.6 Analysis of Complexity ..................................................................................138
  5.7 Analysis of Conformity ..................................................................................139
  5.8 Analysis of the Costs .....................................................................................142
  5.9 Analysis of the Benefits ...............................................................................144

6 Planning: Creating Enterprise Architecture ....................................................153
  6.1 IT Development Planning ..............................................................................153
  6.2 Administering Enterprise Architecture .......................................................157
  6.3 Developing Planning Scenarios .....................................................................159
  6.4 Evaluating Planning Scenarios .....................................................................162
  6.5 Planning Development Measures ..................................................................166
1.1 Overview: The Essence in a Nutshell

7 Implementation: Developing Enterprise Architecture ...........................................167
  7.1 Translating Strategy into Operative Reality ......................................................167
  7.2 Establishing Strategic Architecture Management ............................................170
  7.3 Establishing Operative Architecture Management ...........................................172
  7.4 Establishing an Organization ............................................................................177
  7.5 The Costs of an Enterprise Architecture .........................................................184
  7.6 The Benefits of Enterprise Architecture ...........................................................186
  7.7 Resources: Frameworks and Tools ...................................................................189

8 Safeguarding: Controlling Enterprise Architecture Development ...................195
  8.1 Processes ............................................................................................................197
  8.2 Boards ..............................................................................................................203
  8.3 Measurement Procedures ..................................................................................205

9 Conclusion: Finding the Right Course .................................................................211

10 References ...........................................................................................................219

11 Figures ..................................................................................................................225

12 Index ......................................................................................................................229

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Introduction: When Things Just Work

A well-known commercial from the automobile industry uses the slogan: Isn't it nice, when things just work? Doesn't this slogan also apply to the IT support of your business processes, the alignment of your IT infrastructure and applications development to the strategies and goals of your enterprise? Isn't it nice, when IT does exactly what it is supposed to do - and that cost-effectively, smoothly, and elegantly? My proposition is that this is exactly what the mysterious creatures known as IT architects are there to accomplish with their enterprise architecture (EA), i.e. to simply make sure that things work the way they are supposed to, the way the clients, system operators, and users like. I suppose this might elicit some protest on the part of IT professionals. After all, the clients, system operators, customers, and users do not always succeed in making their wishes clear.

Well, this is precisely why the job isn't trivial, for we are successful precisely when we get things to work, for the benefit of the whole, despite a lack of precision in the instructions and despite moving targets! And yet, the meaning of success is determined by the client, not the architect. “Success is defined by the beholder, not the architect!” (MRE2002) I would like to see this statement together with the above slogan from the automobile industry written in big letters in every IT architect’s office. The IT architect is a mediator between the client’s wish and the technically and economically feasible! This is precisely the nexus at which the IT architect is called upon to support the project manager – by striking up a balance between client wishes, the complexity of the technical implementation and the associated costs for development and operation.

This book is addressed to IT decision makers (CIOs) who face the task of securing and exploiting the overall potential presented by their information systems despite budget constraints. The book focuses on a consideration of the task of establishing governance processes that ensure comprehensive control as one moves from strategic plans to their operative implementation. The book aims to provide a basis for orientation and decision making, to be a management manual for the establishment of an
1 Introduction: When Things Just Work

EA process and an architecture management. It aims to outline how IT governance processes are supported by EA processes that create transparency for decision making and orientation for management tasks.

I wish to disclaim any scientific ambitions or the intention of writing a methodological handbook. Readers who are interested in a more detailed account of the operative implementation of EA may wish to refer to the website for this book, which includes information about an architecture management framework. My aim was to write an accessible book on the subject of EA that is fortified with quotes, accounts of real-world experiences, best practices for developing an EA process and general outlines of how to proceed. It is my view that EA and an accompanying architecture management offer great potential that is too often left unexploited.

1.1 Overview: The Essence in a Nutshell

In the course of writing this book, I was often reminded of a quip that appears in a letter from Charlotte von Stein to Johann Wolfgang von Goethe: “Dear Friend, please forgive me for this long letter, for I did not have the time to write a short one.” Again and again, I was caught between the temptation to go into the details, to address the inner workings of architecture management, and the need to concentrate on the essentials and uphold my commitment to accessibility.

And now my present concern is to compress the whole thing once again into a summary for impatient readers. This abridged version and the subsequent notes on the contents of the individual chapters are also meant to facilitate the use of the book as a guide by offering quick topic orientation and references to the chapters in which the topics are handled in detail.

The central theme and the core statement in a nutshell:

3 www.unternehmensarchitektur.de
1.1 Overview: The Essence in a Nutshell

- The term enterprise architecture (EA) refers to a structured, harmonized and dynamic collection of plans for the development of an enterprise's IT landscape. EA’s various levels of detail and various views enable the enterprise architect to represent various aspects of information systems and their alignment with the business to various stakeholders in the form of past, present and future scenarios.

- EA enables one to determine ones position.

- Architecture management involves planning, organizing, and controlling EA development:

- The architecture management must focus its attention on the purpose of the system as defined by the client.

- EA constitutes the CIO’s management information system. It illuminates the dark and provides navigational information.

The EA Cycle

do
cument! analyze! check! act! plan!
Under the direction of IT strategy and IT governance, requirements and portfolio management, EA management, and program and service management form the IT management framework.

The EA process creates transparency, delivers information as a basis for decision making and control, and thereby enables genuine IT governance.

EA supports the IT management in its effort to do the right things at a minimal risk.
1.1 Overview: The Essence in a Nutshell

- More than 50% of all applications environment analyses reveal redundancies, gaps and breaches.
- The cost of an unnecessary development line is equivalent to the expenses associated with 2 employees per year, plus licensing, updating and training costs.
- Consolidating the infrastructure landscape brings a savings of 10 - 20%.
- Avoid going off at full speed in the wrong direction with an optimally efficient machine.
- Portfolio management and architecture management are complementary.
- In the end, housekeeping is even more important than portfolio planning for new projects: initial development costs account for only 20% of the accumulated costs of an IT application at the end of its service life - integration and operating costs account for the remaining 80%.
- Enterprise architecture (EA) creates transparency with respect to potential risks.
- Architecture management includes mechanisms of risk management.
EA enables one to answer the following key questions:

- What is supported by one's IT systems?
- How is this support realized?
- What resources are used to realize this support?
- What costs are incurred? What benefits? What are the gaps? What are the breaches and redundancies?
- What objectives are met by the deployed IT systems? What is the business case involved? What are the requirements that form the basis of the system?

The structured documentation of EA is the basis for compliance checks. A map is used to describe the relationships between business concerns, applications and infrastructure. Customized EA views are made available to the stakeholders. Deployment scenarios and reference architecture models are the most effective instruments for bringing about architecture convergence and homogenization.
1.1 Overview: The Essence in a Nutshell

The value of EA can be derived from its use as a navigation system for the IT governance process. Do not be content with graphical representations and maps of your applications and infrastructure landscape. Make sure that the valuable information in your EA is also actively used for the analyses and the planning processes that are based on them.

Analysis of the applications environment regarding:

- Interfaces
- Dependencies
- Heterogeneity
- Coverage
- Complexity
- Costs
- Compliance
- Benefits

A heterogeneous infrastructure is usually the result of a heterogeneous applications environment -- and this is where it will be necessary to start consolidating. Let's prevent efficient work at the wrong construction sites!

The following can serve as a golden rule when considering tools for EA management and compliance checks: these must be capable of delivering rapid responses to today's pressing issues, while also possessing the necessary degree of flexibility to handle future tasks.
Development planning is the procedure used by IT specialists to develop the target structure of an applications environment, encompassing business architecture, software architecture and systems architecture:

- Make sure that your EA contents (as-is model) are up to date.
- Derive and develop scenarios based on the EA’s current state (what-if analysis).
- Break the scenarios down into versions.
- Develop your favored scenario into a target state (to-be model).
- Historicize various models within the period of validity.

To-be Model:

![Diagram of To-be Model]

One of the most significant challenges on the way to establishing a well-functioning architecture management is to overcome the gap between strategic planning and operative implementation:
1.1 Overview: The Essence in a Nutshell

Technical requirements are ascertained and structured in the context of requirements management. Architecture management is responsible for the housekeeping. Under the direction of IT strategy, the results of requirements and architecture management flow into portfolio management whose results, in turn, flow into development planning.

Program and service management are responsible for project, program and line implementation. The transformation of business and IT strategy into operative reality is controlled by the governance process.
The processes of strategic and operative architecture management must be binding in nature. Avoid excessively long discussions. There is a tendency in the area of IT to talk at length about the subject of architecture!

Architecture management organization

- Central
- Local
- Diversified
- Dispersed

The development and maintenance of EA as an instrument of navigation for IT governance requires a human resources commitment of around 0.7 – 1% of overall IT capacity.

Via processes, boards and measurement procedures:

- Binding initiatives
- Consultation and participation
- Results orientation
- Promotion
- Support
- Agility
- Measurability

Boards:

- Governance board
- Architecture board
- Sounding board

Measurement procedures:

- COBIT®
- Architecture management scorecard

10

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1.2 Orientation: Notes for the Reader

While the examples used in this book stem primarily from the banking and insurance sectors, they can easily be applied to other sectors. The subject of enterprise architecture (EA) is relevant to all enterprises.

The models used in this book have been simplified and will present no surprises for advanced readers. On the contrary, some readers may feel compelled to call attention to missing details, point out exceptions, and caution the need for a more precise fleshing out of the operative implementation. I concentrate in this book on a presentation of the big picture, on creating an overview in order to give readers an opportunity to plan their own expeditions using their own situations as base camps. I intend to show a number of maps, identify the main attractions along the way and call attention to poor route conditions. While it is not my aim to supply a detailed map of the way (one including all of the GPS coordinates) I do provide a closer look at a few particular cases. In general, however, I wish to follow the advise of T. Gilb (GIL1988) and keep my objectives in the realm of the achievable.

The models that appear in this book were thus drafted in accordance with the KISS principle: Keep it simple and smart. More in-depth information is available in the numerous reference works cited and on this book’s website (whose feedback option readers are strongly encouraged to use).

In Chapter 2 of this book, I am concerned to establish foundations, define terms, outline connections and otherwise equip the reader to take a closer look at the subject matter.

In Chapter 3, I examine the benefits that enterprise architecture (EA) offers for IT governance in your enterprise and what goals are associated with it. EA creates transparency, establishes a foundation for the identification and control of measures that enable one to optimize IT efficiency, effectiveness and reliability.

In Chapter 4, I offer an explanation of EA structure, introduce its various components and the relationships among these, assess representational forms and present a sketch of an EA metamodel. This discussion should assist you when it comes to ascertaining and documenting the structure of your EA.

4 www.unternehmensarchitektur.de
In Chapter 5, I introduce the subject of EA analysis procedures. The discussion here centers on the use of one information system and the evaluation of the attributes and relationships it contains. Particular points of interest include system heterogeneity, degrees of coverage, complexity, costs and benefits. This chapter will help those who would like to use an existing EA process to achieve the degree of transparency that is necessary for effective IT management.

In Chapter 6, I introduce the subject of development planning. How do we channel analysis results into our efforts to plan IT development? How do we arrive at the target architecture, i.e. the photograph of the target state? How are we to assess development alternatives? This chapter offers practical tips on the subject of IT development planning.

In Chapter 7, I am concerned to present a set of best practices for constructing EA. How are we to bridge the gap between strategic planning and operative implementation? What processes will be necessary in this context? What tools can be expected to help? What will be the cost? What will be the benefits? The discussion here offers practical tips and other valuable information on EA development and use.

In Chapter 8, I turn my attention to the subject of controlled EA development. How are we to measure, control and secure the implementation process? How are we to measure architecture management? How are we to use EA as a management information system that enables one to catalogue key figures and performance indicators in support of IT governance?
Foundations: Finding the Starting Point

Isn't it nice, when things just work?

On the first leg of our journey through the world of enterprise architecture (EA) and IT governance, I would like to offer a description of the main features that come into view, the landscape, the flora and fauna. This aim of this guidebook is to help us to better understand subsequent observations on the subjects of EA documentation, analysis, planning, implementation and control in the context of IT strategy and governance.

This chapter will provide us with definitions of the most common terms: What is EA? How does it differ from IT architecture? What is architecture management and what role is played by the IT architect? What is the relationship between IT strategy and IT governance? What are the relationships among EA management, portfolio management, requirements management, service management and program management? The defining of terms, the use of examples and the identification of lines of demarcation are to prepare us for a more detailed examination of the substantive issues.

2.1 Enterprise Architecture (EA)

Just like buildings, enterprises can be described in terms of their architecture. Sometimes this architecture is the result of planning, sometimes it simply arises. Sometimes there is an awareness of the architecture as such and attempts are made to exploit the potential it offers. Sometimes it is simply there.

Virtually every enterprise with a sufficiently large IT division has access to plans: data models, business process models, component models, structure diagrams, network plans, inventory lists, infrastructure plans, hardware lists, function trees, etc. Even without IT, enterprises have plans: organizational charts, workplace descriptions, procedures, strategies, etc. Plans are necessary for setting up and operating complex systems. It is only with the help of plans that we can understand large systems. The combined IT that is used to support a large enterprise is a system that is comprised of a complex aggregation of systems. EA is
You already have EA!

This is exactly why you already have EA. But do you also use this architecture? Do you draw the connections from business process diagrams to component diagrams and infrastructure plans (e.g. in order to document the IT support of your business processes)? Do you analyze these relationships with regard to dependencies, costs and capacity utilization? Do you evaluate the quality of your applications environment for your business? Do you analyze your infrastructure landscape to ascertain redundancies and degrees of capacity utilization?

Do you use your EA?

And is this collection of plans that you have, this representation of the current state of your enterprise, good enough to be put to effective use? Are the plans sufficiently up to date and sufficiently comprehensive? Do they relate to one another? Are they syntactically and semantically aligned? Or does the collection look more like a disparate array of city and highway maps of a different scope, scale, date of issue, and origin?

EA is indeed not optional, it always exists. Sometimes it is well-planned and developed. Its viewers see a harmonized grid of streets, buildings and utility lines. Sometimes it arises more haphazardly. If they could venture a look, its viewers would see various districts undertaking to build streets, houses and utility lines more or less in oblivion to one another. Do you have any experience with such IT Blaumilch Canals?

EA scope is a matter of needs.

Enterprises have different requirements when it comes to the breadth and depth of their architecture models. Small enterprises exhibiting little IT penetration (e.g. in the construction sector) tend to handle this task on the fly. Large corporations with a high degree of dependence on IT support require high-performance models and processes to secure EA development and maintenance.

How urgent is the introduction of EA?

The need to establish an EA process can be derived from the dynamics and complexity of the enterprise itself. Market developments, changes in business sectors, organizational adaptation, mergers and other major changes result in a high degree of volatility for an enterprise and its surroundings. This volatility generates requirements that are to be met by IT. These requirements make EA an indispensable instrument of analysis and control. The complexity of a given enterprise (e.g. based on its size, structure and geographic distribution) also generates such e-
2.1 Enterprise Architecture (EA)

quirements (see Figure 2-1). An intensification of these factors will increase the degree of urgency with which it may be necessary to establish an EA process in your organization. While one may be able to put off coming to terms with the urgency for a time (e.g. via virtuosity in the management of ones IT assets, experience and a high degree of technical sophistication in your IT organization), the more complex and dynamic your enterprise becomes, the more likely you will be to experience the disadvantages of doing without the instruments of navigation afforded by EA.

Finding the right level of detail and abstraction is one of the main success factors for securing the benefits of EA. Beginning at a level that is too abstract will entail endangering the transition to comprehensive operative implementation. While the contents may be suitable for strategic discussion at the level of the CIO, cohesion at the operative level, a condition for governance during implementation, will be missing. I will devote somewhat more attention to the issue of bridging the gap between strategic and operative architecture management in Chapter 7, Implementation: Developing Enterprise Architecture). On the other hand, beginning at a level that is all too concrete, will in-
volve the risk of becoming awash in the details. Finding the right level of detail involves orienting oneself to ones EA goals, i.e. by focusing on the purpose of its introduction and not on its introduction as an end in itself. Further variables that will influence the right degree of abstraction include the size of the organization, the degree of its geographic distribution, and its structure, as well as budgetary matters and special situations (e.g. in the wake of mergers or acquisitions). Beyond this, it will be important to exercise good judgment, draw upon ones experience and apply a coherent set of rules. However, given that no ideal gauges have been developed, one will have to stay alert!

Now, let's have a closer look at what we mean when we use the term enterprise architecture. The architecture of a building, for instance, can be described in terms of a set of plans:

- Blueprints and floor plans
- Cross section diagrams
- Routing plans for gas, water and electricity
- Capacity analyses for ventilation, heating and air-conditioning
- Site determination plans

All of the various types of plans will not be necessary for every building: simple garages usually have only one floor, single-family units seldom require complicated plans for ventilation and climate control.

As it turns out, the architecture of an enterprise can also be described in terms of a set of plans:

- Operationalized enterprise and IT goals
- Business process models
- Organizational models
- Development plans for IT applications and infrastructure
- Analysis models for IT applications
- Technological models for IT infrastructure

EA is a collection of plans that represent business aspects (e.g. goals, conditions, business processes), business aspects of IT support (e.g. application systems, data records, individual programs) and technical aspects of IT support (e.g. computer platforms, networks, software components) as these interact in past.
present and future instantiations. Given that each of the above-mentioned aspects may possess a considerable degree of complexity in and of itself, it is usually the case that system excerpts or views are represented by multiple plans. Views are generally formed when one attempts to represent aspects that are relevant to specific stakeholders.

An EA model enables one to compile operational aspects into a business architecture model, aspects of specialist IT support into a software architecture model, and aspects of technical IT support into a systems architecture model. This gives rise to an EA pyramid of the sort shown in Figure 2-2 below.

![Figure 2-2 The EA Pyramid](image)

**City planning versus building construction**

Although the term architecture was introduced to the area of IT a number of years ago, the mention of enterprise architecture, a construct or process that requires a much closer connection to business strategy and that cannot be developed at all without a precise understanding of business processes, tends to elicit immediate questions as to the demarcation between it and forms of IT architecture (e.g. software architecture). The comparison between city planning and the architectural planning of individual buildings is often used to clarify this demarcation. Just as EA specifies the interaction of many individual elements, the city plan describes the network of streets, utility lines, public spaces and buildings, commercial and residential areas, and the integra-
The term architecture is used in the context of city development and house construction both for the planning of a future state and for descriptions of current states. If we speak of the architecture of a building or a city district, we intend to refer to what we perceive: floor plans, utility supply lines, access roads. We use the very same term to refer to a model of the building or the city district. Here, the focus is no longer on ones perception, but on its anticipation with the support of paper, model board and computer screen. The plans that we are talking about are at one and the same time maps and routes.

Architecture always involves building plans for future systems as well as the documentation of existing or replaced systems. An EA model thus contains (at each of its various levels) views that represent building plans for future systems and views that document existing or replaced systems. Both deployment options (implementation and site plan) are necessary at the strategic level of the development plan and at the operational level of the project.

Likewise, each of the EA plans mentioned may also possess several past and future scenarios in addition to the current state. Moreover, with regard to the current state, there may be historical or future scenarios, various versions of plans (e.g. scenarios of a network plan for various sites or alternative planning scenarios for the development of the applications system, including custom software, standard software or application service providing). These various historical states and versions of the plans must be commensurable in order to support the process of development planning. For instance, if a current plan for the applications system includes the identification of cost drivers in operations and these weak links are to be eliminated, then it will be necessary to draft and evaluate alternative future scenarios.

Architecture models thus help us to plan new versions of an applications environment or new systems. They establish specifications, define construction principles, and determine the infra-
2.1 Enterprise Architecture (EA)

structure that is to be deployed. But architecture models also help us to navigate within a currently existing applications environment, analyze a currently deployed system, ascertain degrees of capacity utilization and types of infrastructure deployment, and to identify interfaces. This is precisely what we do again and again when we perform the following tasks:

- Plan new systems in order to specify their interfaces
- Replace old systems with standard software in order to plan for the migration of data records and the establishment of new interfaces
- Consider necessary changes in our applications environment (e.g. new zip codes or legal stipulations)
- Consolidate applications and/or infrastructure landscapes
- Define our service catalogue in the context of an outsourcing project

Any time you face these tasks, you are also concerning yourself with architecture: you develop architecture models, you read them, you interpret them, and you draw the necessary conclusions. The models are then usually forgotten. While they may continue to be used for the maintenance of individual systems, they will no longer be systematically updated and maintained. And this why it is often the case that many EA elements have already been developed, and not just once, but many times. Have you, too, ever counted how many inventories of your applications environment were taken in the last, let's say, 10 years? By the staff involved in the last major project that affected the entire landscape, by the strategy consultants who were commissioned by the executive board to identify potential for increasing IT efficiency, by the staff of the Year 2000 Project, by the management consultants who were to develop a service and customer orientation program, but which unfortunately was not able to draw upon the model devised by the previous consultants because it was only available in paper form?

But what is the purpose of it all? Do we not have a handle on our own shops? Are we so lacking in virtuosity when it comes to using our own IT toys that we need such complex and questionable efforts? Or do we already have all these plans - on various walls in the offices for business process modeling, applications
development, network administration, etc? Is someone trying to sell us old wine in new bottles?

One often encounters the theory that business realities, business environments, and markets (and IT landscapes along with these) change so quickly that it no longer makes sense to plan at the drawing board (WIN2004). It follows that EA is necessarily obsolete and a bad investment. This discussion neglects an important factor: the value of EA does not arise from strategic planning alone. The value of EA is given by its mere existence. For how else are we to respond to rapidly changing markets and business circumstances if we do not know where we are, if we cannot see the forest for the trees?

Just as the utility of a map and a compass begins with a determination of position, and then expands as they are used to chart a course and navigate, the utility of EA begins with the documentation and analysis of the current state of IT support so as to derive the right new plan.

The question of whether we can plan EA models in short cycles on the drawing board does not even arise. First, it will be necessary to exploit the potential wrapped up in our existing models and to close the gaps in our existing models. While we will certainly have to be agile and flexible, and we will certainly have to be diligent about keeping our models up to date, this does not mean that it would be better to leave everything the way it is? Why should we refrain from exploiting existing potential?

I wish to endorse a dynamic EA process, a practice of planning that is oriented towards requirements and business objectives and that represents a continuous source of knowledge, a type of planning that aligns various independently developed models, reveals their dependencies and makes them subject to evaluation and useful, and a type of planning that ensures that these models are maintained and kept up to date. I wish to endorse the notion that one should not only document EA models, but one should also actively use them, analyze them, deploy them as a foundation for planning, and then implement the plans themselves. My endorsement assumes that the purpose of EA includes getting things rolling. As is so ingeniously expressed in the automobile advertisement quoted in the introduction: Isn’t it nice, when things just work?

By way of summarizing, I would like to present my definition of EA:
The term enterprise architecture refers to a structured, harmonized and dynamic collection of plans for the development of an enterprise's IT landscape. This architecture:

- is arranged in various levels of detail and views
- is specifically designed for certain stakeholders (e.g. managers, planners, owners and designers)
- illustrates different aspects of IT systems (e.g. data, functions, interfaces, platforms, networks) and their alignment with the business (e.g. objectives, strategies, business processes) in past, present and future scenarios.

This definition applies to EA as an established item. But how do we construct EA? How do we use it? After defining the term IT Architecture, I will proceed to address these questions in a more in-depth discussion in Chapter Fehler! Verweisquelle konnte nicht gefunden werden.

2.2 IT Architecture

IT architecture is a blueprint for an IT system. The blueprint describes the system's structure in terms of components and layers, specifies the tasks and capacities associated with the components and layers, and aligns the components to various functional and non-functional requirements:

- What component is necessary to meet a specific business or technical requirement (e.g. a retirement calculation or 24*7 availability)?
- What requirements are met by each component?
- What components generate new requirements (e.g. a specific database system)?
- What requirements are mutually dependent or contradictory?

The blueprint also specifies the interfaces between the components and layers and between the system and its external environment. Moreover, it establishes conventions for the realization of interfaces and describes the system's communication behavior.

The ANSI/IEEE Standard 1471-2000 tells us:

"Conceptually an IT architecture is the fundamental organization of a system, embodied in its components, their relationships to
2 Foundations: Finding the Starting Point

each other and the environment, and the principles governing its design and evolution.

Practically it is represented in architectural descriptions from the viewpoints of the stakeholders.

An extensive collection of definitions is provided by the Software Engineering Institute under the title “How Do You Define Software Architecture?”. (SEI2003). Among many other definitions, I found the following submitted by B. Boehm:

- “A collection of software and system components, connections, and constraints.
- A collection of system stakeholders’ need statements.
- A rationale which demonstrates that the components, connections, and constraints define a system that, if implemented, would satisfy the collection of system stakeholders’ needs statements”.

2.3 Architecture Management

Architecture management involves the planning, development, use, and maintenance of ones EA. It organizes the relevant processes, and guides and controls development. Architecture management can thus be said to prescribe methods of achieving the close integration of business processes, IT applications and IT infrastructure.

Architecture management is responsible for:

- The strategic processes for documenting, analyzing and planning EA
- The operative processes for the comprehensive implementation of EA and for checking its compliance with reference architecture models and defined infrastructure standards
- The defining of documentation procedures
- Analysis and planning methodologies
- Evaluation procedures
- Tools and their integration into the tool landscape
- Procedures and responsibilities
- Key figures and controlling
2.3 Architecture Management

Architecture management has an operative and a strategic dimension. Strategic EA documentation, analysis and planning are expected to generate measures that are to be implemented in projects or line activities. Architecture management is also required to offer concrete support (e.g. by developing reference architecture models in the areas of software and systems architecture and monitoring their implementation and deployment) and, in general, get things rolling.

Architecture management comprises all of the processes, methods, tools, responsibilities and standards that are necessary to get things to work, to make sure that IT systems do exactly what they are supposed to do - and that cost-effectively, smoothly and elegantly. Put simply, architecture management is the process that accompanies EA.

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Architecture management is the instrument used by the IT management to do the housekeeping, i.e. to maintain the applications environment and infrastructure landscape, maintain and increase the value of existing assets, integrate new components seamlessly, create balance and get everything to work. Housekeeping is the order of the day when one’s budget for new projects is on the decline!

2.4 The IT Architect

From the client’s point of view, the function of the architect as a mediator in matters of client wishes and the technically and economically feasible can be described using our often quoted slogan: Isn’t it nice, when things just work? The moment of the IT architect’s greatest success is also when things just work – both technically and in business terms.

The IT architect applies methods, deploys tools and heuristic techniques, communicates with the IT unit’s clients, as well as with other units, including applications development, infrastructure, acceptance and deployment, and system operations. The IT architect uses a holistic approach to arrive at the best possible solution, i.e. the solution that meets client expectations, that exhibits the greatest cost-effectiveness, that conforms to standards of applications development and operation, and that is robust, easy to maintain, low-risk, and free of unnecessary complication.

The literature continues to convey the notion that an IT architect operates primarily with non-measurable elements, deploys non-quantitative tools, and is guided predominantly by experience. Architectural work is regarded as an inductive process. In contrast, engineering is regarded as a field whose practices are derived from hard science and are matters of deduction, a field in which analytic tools are deployed and whose results are based on measurement and are quantitatively verifiable (JAC2004). The distinction drawn here is certainly exaggerated. Maier and Rechtin describe the role of the IT architect as that of an interpreter who is called upon to translate the concepts of clients facing tasks and the concepts of the developers offering solutions. These authors also suggest that good IT architects are capable of going beyond the role of the interpreter to develop their own visionary models for combining purpose and technology, models that surpass the expectations of clients and developers (MRE2002).
What all of these definitions have in common is that they specify the objective of the system as defined by the client as the proper focus of the IT architect's efforts. Here is an often quoted example: President Kennedy never said: "Build me a 3 stage rocket with a lunar module." What he did say was: "We will be the first to go to the moon!" According to Meier and Rechtin, a system will be successful if it helps one meet a meaningful objective in an acceptable amount of time and can be realized at a cost that is affordable. The meaningful objective is the crucial element here.

IT architects are bound to this very criterion: realizing a quality system with a meaningful and beneficial objective in an acceptable amount of time and at a price that is affordable.

IT architects do this exactly like their counterparts in building construction do at drawing boards: they do it with models. Modeling is one of the core responsibilities of the architect. But here it is important to recall: the client and the developer have to be able to understand the modeling. The modeling task should not be allowed to develop into the secret domain of the IT architect. Notations that are not understood, accepted or used by the client or the developer are useless. IT architects who offer such are guilty of wizardry.

This applies as well to all of the other tools and methods used by an IT architect. Everything has to be adequate in the eyes of those in the target group. Everything has to be comprehensible and accessible. The EA framework is required to clearly and straightforwardly serve the aim of getting things to work.

If the IT and enterprise architect assumes this role, if EA and architecture management are established in the form outlined, then the way has been paved for the introduction of an IT management framework (see Chapter 2.9, Enterprise Architecture in an IT Management Framework) in which technical requirements and housekeeping flow into portfolio management in a synchronized manner and are controlled under the guidance of an IT strategy via governance processes.
2.5 Corporate Governance

Searching for definitions of the term Corporate Governance, we find (e.g. in Germany's Corporate Governance Code) (DG12003) that corporate governance "contains essential legal directives to the direction and supervision of German listed companies [...] and defines international and national standards of good and responsible business management." Further, it is stated there that: "the board of directors develops the strategic alignment of the business and provides for its implementation. [...] The board of directors is responsible for the appropriate risk management of the enterprise."

The principles of good and responsible business management, strategic business alignment and performance and appropriate risk management are therefore the obligations of the senior management of our enterprises. What IT managers would not react with enthusiasm when asked to contribute to the implementation of these principles? And these managers would almost certainly point out that information is the key to the success of the corporate governance program, that business management requires transparency and that every implementation of strategy depends on clearly defined goals and access to all relevant information, that risk management and controlling cannot take place in the dark, but only in the light of a transparent information base. These managers might conclude their observations by pointing out that IT involves the use of information systems to produce exactly this light, without which every form of control, every attempt at navigation, every inspection and course correction would be destined to fail.

Adherence to governance principles also means making informed decisions. Governance presupposes planning, organization, inspection and control, or, in short, management on the basis of comprehensive information.

What does the IT division do now in order to support planning, control and steering processes of the business departments, to help in reorganization and alignment and to assist with the implementation of corporate governance principles? It delivers exactly this comprehensive information with data warehouse systems, business intelligence suites, and management and executive information systems. The management of the business departments will primarily use these systems to facilitate the optimization of the business, to cut costs, to open new markets, to
2.6 IT Governance

develop or to place new products. It is precisely these systems that support good and responsible business practices, strategic alignment of the business and its performance, and appropriate risk management along with the information they provide to the leadership.

Let's consider the following example: based on its financial indicators, the board of directors recognizes that a business unit does not function profitably. The directive for the management of the business unit is to reduce costs and increase revenue. What do the managers of this business unit do to implement this directive? Any course of action will likely begin with an analysis of the current situation - in order, for example, to outline the cost distribution across the departments of the business unit or in order to understand precisely the revenue variance across the distribution channels. The factual basis for this analysis is gained from the enterprise's information systems. IT systems are also likely to play an important role in managing the strategy based on the analysis.

IT thus plays an important role in corporate governance. This has also been shown in numerous legal specifications, e.g. the Sarbanes-Oxley Act, Section 404 (SAR2002), or Solvency II (ZBR2004), which place increased demands on enterprises' internal control systems and IT. But what about the current state of governance in the IT division itself?

Let's look at another example: the board of directors decrees cost savings that result in a 15% reduction in the IT budget. Now our CIO is in a similar situation to that of his business department colleagues in the above-mentioned example. But what information system does the CIO have to generate an initial analysis in order to prepare an appropriate strategy? Where do we find an information basis that shows us IT applications, IT infrastructure components, their relationships to the business (in terms of both organizational units and business processes) and in addition costs, risks, running projects and available IT staff resources? How do we make all of this information available for further analysis? Do we once again have a case here of the shoemaker having the worst shoes? Does the IT division deliver the critical information for an implementation of corporate governance for
all company divisions, but not have the tools to develop and steer its own IT governance processes?

Where do we find the management information system for the CIO? Where is the model that documents the IT assets with all their dependencies, points of impact and relationships in a way that they become transparent, analyzable and manageable? We find the answers to these questions in EA. The EA is the model that documents the IT assets and their relationships in the required format. It delivers the analysis and planning support that is indispensable for effective IT governance.

The IT Governance Institute (www.itgi.org) defines IT governance as follows: “IT governance is the responsibility of the board of directors and the executive management. It is an integral part of enterprise governance and consists of the leadership and organizational structures and processes that ensure that the organization’s IT supports the organization’s strategies and objectives. IT governance ensures the following:

- Fulfillment of the expectations on IT
- Continuous planning, control and optimization of IT resource deployment
- Measurability of IT performance
- Risk minimization

Fulfilling expectations is a matter of doing the right things and acting effectively. Planning, controlling and optimizing the use of IT resources and measuring the associated performance is a matter of doing the right things and acting efficiently. Minimizing risks is a matter of creating security.

In essence, it is about effectiveness, efficiency and reliability: do the right things at the right time in the right way. EA gives us the necessary overview and understanding of the interconnections of business goals, business processes, department requirements, projects, IT applications, IT platforms and IT infrastructure. It ties these elements together, reveals hidden points of impact and dependencies, documents costs, risks, availability, stability and many other attributes.

And yet EA can deliver much more. Not only does it document the current situation, it also delivers the procedures for the analysis of weaknesses. Where are the cost drivers in the applications environment? Where do redundant development technologies exist? Where is the level of support for business
2.7 Enterprise Architecture as a Basis for IT Governance

Where do redundancies exist? Where is the level of support for business processes unsatisfactory? Where do other redundancies exist? This as-is analysis is the basis for an effective IT governance process. It is a key component of corporate governance and therefore indispensable.

Development of planning scenarios

This analysis leads to the planning and implementation of measures. EA helps us during the planning phase. It is the basis for the development of planning scenarios that allow us to assess alternative paths of IT development. EA is accordingly a central instrument of every governance program. How are we to lead, direct and steer if we do not know where we are, what the path looks like and where it is supposed to go?

2.7 Enterprise Architecture as a Basis for IT Governance

The suggestion that there is a vital connection between EA and IT governance has received much corroboration of late: by manufacturers, analysts, consultants, and users (architects) who contribute to the discussion by drawing upon their experience with the integration of architecture models, portfolios, programs, projects and services in the context of IT strategy and IT governance. However, what is the significance of the often cited IT governance framework in which EA management, portfolio management and program and service management coalesce? What is its utility? What value arises from it? What significance does it have for an up-to-date IT management? What are the connections between IT governance and EA? What does it mean exactly to make informed governance decisions as opposed to operating in the dark?

Example

By way of responding to these questions, I would like to use an example relating to the need to cut costs in an enterprise’s IT division. What usually happens when the CIO receives an order to cut costs in the amount of 15%? The search for cost saving potential begins. Figure 2-5 offers us a typical overview of the distribution of costs in large IT divisions (Gartner Survey 2001).
Given the significant reduction in new development versus maintenance in recent years, my example assumes a rate 50% for corrective maintenance and 50% for development and adaptive maintenance. It follows that approximately 18% of the IT budget is spent on innovation in the area of development. In the operational area, I assume a rate of 10% for innovation (i.e. invested in technology projects). In our base scenario, we therefore have a rate of only around 23% for the kind of real innovation that can increase the value of our IT for the business.

These assumptions largely corroborate the findings of a recent research project (PFE2003) that indicate a considerable reduction in recent years in the resources allocated for innovation as a percentage of enterprises' total IT budget (see Figure 2-6). More recent observations indicate an even more significant reduction in resources allocated to innovation. This is reflected in the assumptions used in the example.
2.7 Enterprise Architecture as a Basis for IT Governance

So what will the CIO in our example do to implement the 15% budget cut for IT? Given that it is difficult to reduce operational costs in the area of corrective maintenance because of the long lead times needed to plan for such cost saving programs,⁵ the obvious road to short-term savings is usually taken: the investment budget for new application development and technology projects is cut. After recalculating the total budget to the new baseline of 85% of the original budget (see Figure 2-7), we arrive at the following revised relative allocation of funding:

- 27% for development (including 6% for new development and adaptive maintenance and 21% for the more resistant corrective maintenance)
- 16% for the organization (a relative increase as opposed to short-term savings)
- 57% for operations (with a technology projects budget reduced to 4%)

The portion of the IT budget that is available for real innovation thus sinks to 10%.

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⁵ E.g. cost savings typically obtained by consolidating the infrastructure, optimizing systems, outsourcing, and optimizing the organization.
Ever since the presentation given by Stephen Norman, CIO of Merrill Lynch, to the MIT CIO Summit on May 22, 2003, we know that many executives regard their IT divisions as magic oranges that can be repeatedly squeezed (n times!) to repeatedly quench their thirsts for fresh juice (LUT2004). We can therefore assume that the situation hypothesized in our example will repeat itself in economically bad times year after year with ever new budget cutting orders.

The result shown in Figure 2-8 indicates that reducing IT spending correlates to reduced innovative capacity - a dangerous situation for the IT division and the enterprise as a whole. If this magic orange also belongs to the standard cost-cutting repertoire in your enterprise, then it is virtually certain that you are also faced by a sustained decline in the innovative capacity of your IT division, a situation that warrants intervention. This represents a classic example of a governance task that requires the support of EA.
How does one approach such a challenge? It is important to be able to identify optimization potential in operations, in organizational structure and corrective maintenance, and to initiate the corresponding cost-saving measures in these areas. The implementation process needs to be closely managed. Metrics and control procedures need to be established. After all, this concerns a restructuring of the IT portfolio that will be crucial to its survival. This makes governance indispensable.

In the wake of the assumed IT budget cut of 15% (columns 1 and 2 in Figure 2-9), we are left with a share of 21% for maintenance, 16% for organization and 53% for business and infrastructure. In order to create capacity for innovation of the sort urgently needed for an improvement in the position of the IT division, it will be advisable to search the three areas for ways of bringing about optimization (column 3 in Figure 2-9). In doing so, the minimum aim must be to return the innovation budget to the base level shown in Figure 2-5 in order to ensure that one is equipped for future challenges (columns 4 and 5 in Figure 2-9).
The optimization of operations, infrastructure and maintenance is contingent on the establishment of an overview, a documentation of the applications environment and infrastructure landscape of the enterprise. While it suffices in small organizations to be mindful of the overview, large organizations need something more: a list, a plan, a model, an information system or, simply put, EA. If we consider the magic orange and remind ourselves that what we are dealing with here is not a unique situation, but a recurring task, then much speaks in favor of EA whose maintenance is performed in the context of a continuous process.

The CIO’s management information system is then continuously available and up to date, and helps one to identify dependencies and risks, gaps and redundancies, complexities and interfaces, heterogeneity, lack of conformity, cost drivers and utility blockers. EA makes the IT portfolio analyzable, supports the strategic planning process by providing “as-is” and “to-be” models, and contains key performance indicators. It is therefore a powerful instrument in the governance process.

EA represents the CIO’s management information system. The analyses and planning procedures established in connection with EA create business intelligence for the IT division. EA thus represents the foundation for any IT governance program.
EA highlights the connections between business processes, organizational units, application systems, platforms and infrastructure systems. Without the documentation of these connections, attempts to optimize operations, infrastructure and maintenance will be like taking a journey in the dark without a map, without equipment and without food. One often starts with the objective of “pragmatic action” and optimizes where the weaknesses are obvious. This is often in the area of infrastructure where cost drivers can be identified quickly. And just as quickly the optimization process is derailed because the dependencies involving the applications environment and the business were not taken into consideration.

Have you ever heard of the lamppost analogy?

On a dark night, a man was on his hands and knees under a lamppost searching inch by inch for a lost object. A policeman came along and asked what he was doing. “Looking for my house keys”, was the answer. “And where did you drop them?” “Over there by the bushes”, was the answer. “Then why are you looking here?” “Because the light is better.”

In our attempt to enable our IT division to prepare for new challenges and to reverse the decline in innovative capacity, we should also take a look in the dark, where it is cold and uncomfortable, and where dependencies exist that may give cause for uncomfortable negotiations with the business side. It will always be necessary to consider these dependencies, business relationships, and other overarching factors if a really comprehensive optimization is required – whether this is a matter resembling our example of a massive budget cut or because a merger has left its mark on the IT landscape. In such cases, the optimization must begin at the top, with the business and with the applications environment. After all, heterogeneity, inefficiency, and infrastructure duplication are usually a result of a suboptimal applications environment design. Complex interfaces, heterogeneous and redundant development technologies, unexploited reuse potential, redundant systems, unfinished migrations, deficient applications environment integration – these are frequently the true causes of unnecessary complexity, inefficiency, and high costs in the infrastructure landscape. Diagnosing these causes requires the holistic analysis enabled by EA.
It follows from this that enterprise architects should align their work to these requirements and increasingly regard EA as a means of IT governance.

2.8 Establishing and Using Enterprise Architecture

The definition makes clear that EA is supposed to enable us to answer the often posed questions about the starting point, the nature of the route and the goal of our journey that will lead us through various IT landscapes, with an eye towards increasing efficiency, oriented on the business and its dynamic changes, and keeping an eye out for hidden risks. The task of steering along this route is what we refer to as IT governance, and EA is the instrument of navigation, the GPS of the CIO.

This analogy will help us to better understand what the essential steps are in the establishment and use of EA. As in the case of a journey, we will first need a roadmap, a kind of documentation of the area in which we will travel. This is the EA, which is comprised and constructed out of the elements of many existing models, including business process models, organization models, IT product lists, IT infrastructure catalogues, etc. The construction requires a semantic and syntactic alignment of the available models so as to enable efficient referencing between the models and their various levels.

As soon as we have obtained a map of our travel destination, we can turn our attention to the task of obtaining information about sightseeing attractions, hotels and street conditions. We read guidebooks, refer to the Internet and consult with our automobile association until we have analyzed all of the relevant materials. EA also reveals its real value only after one ceases to regard it as a static entity, but as a dynamic instrument that can be actively used for purposes of analysis. The heads of many enterprises begin to grasp the value of EA only after it really comes into use as the CIO’s management information system.

Once we have checked our maps, guidebooks and highway descriptions, it is time to plan the route. We will likely need a number of attempts to ensure that we will be able to conveniently take in all of the main attractions. What we wind up with is a route plan that, together with our usual vacation checklist for the contents of our luggage, represents the starting point of our journey. The analysis of the EA must find its continuation in the development of planning scenarios that address identified weak-
nesses found along the way and outline possible solutions. In what follows, I turn my attention to the evaluation of planning scenarios, the development of a target plan and the drafting of a base plan whose contents will then flow into the project portfolio and the program management so that the strategic plan can become reality.

Once our journey has then actually taken place (hopefully having brought us a number of adventures and valuable experiences), the culmination of the journey will be showing our vacation videos to friends and family. In the case of EA, the planning is also followed up by implementation and control.

As depicted in Figure 2-10, EA that has been designed for use in the immediate context of an IT governance program develops from a cycle consisting of documentation, analysis, planning, implementation and control.

Figure 2-10: The EA Cycle

Chapters 4 to 8 in this book present ways in which EA can be structured and documented, procedures for using and evaluating this documentation, ways of developing target scenarios, the contribution made by architecture management when it comes to implementation, and ways of controlling and securing the whole process.
2 Foundations: Finding the Starting Point

2.9 Enterprise Architecture in an IT Management Framework

If one creates and develops enterprise architecture (EA) in accordance with these principles, then it will effectively support IT management, promote governance and strategy fulfillment, and plays an important role (along with portfolio management and program management) in fulfilling the task of implementation (Figure 2-11). This will then elevate the status of EA management on the enterprise's business agenda.

![Figure 2-11: IT Strategy Framework](image)

Figure 2-12 below offers us a view of the interaction that takes place among the processes of requirements, portfolio, program, service and EA management as guided by IT strategy and IT governance.

IT strategy supplies the score for this orchestra, requirements management takes care of the wishes of the audience, EA management provides the concert hall, maintains the instruments and
2.9 Enterprise Architecture in an IT Management Framework

ensures good lighting, portfolio management harmonizes the wishes of the audience, orchestra and conductor according to the available budget, and program and service management provide for logistics and entertainment.
Figure 2-12: IT Management Processes
2.9 Enterprise Architecture in an IT Management Framework

EA gives the IT management processes the necessary orientation. It helps to determine position, course and reliable course detours. In the following chapters we will take a look at the processes involved in the development and use of EA. Figure 2-13 below offers an overview of these processes:

Figure 2-13: EA Development
3

Goals: Doing the Right Things Right

Before the flight it's opinion, after the flight it's fact!

While few of my readers will be content with this familiar quotation from the aviation industry as a response to the issue of the costs and benefits of enterprise architecture (EA), it nonetheless offers us a kernel of truth: only the real flight, i.e. the real establishment of EA, will provide us with the facts we need to evaluate the costs and benefits associated with a particular case.

For this reason I would like to begin my discussion with an examination of the potential benefits or goals pursued by EA management. What can we reasonably expect? What will we need to concentrate on? What are the various fields of action?

When we consider EA from the viewpoint of IT governance, we are primarily concerned with transparency: information as a basis for decision making and control. However, as we saw in the previous chapter, it is more than just a matter of a static construct that is referred to using the term EA. Indeed, it is also a matter of architecture management, organization and continuous processes. It is a matter of the sustained and continuous provision of the kind of information that enables governance. And it is a matter of acting within the context of IT management to bridge the gap between strategic planning and operative implementation.

This is why our sightseeing flight is not only connected to the goal of establishing an overview and transparency. We also want to do very concrete things: optimize our applications environment and infrastructure landscape, align our IT to our business goals, make our risks manageable, etc. This is the subject of the present chapter.

Later, in Chapter 7, I will offer an assessment based on various real flights, including an analysis of the costs of establishing EA, an appraisal of its benefits, and a discussion of what one learns by experience.
3.1 The Potential Benefits of Enterprise Architecture

In what areas are the benefits of EA most evident? The answer to this question can be derived directly from the material that we analyzed in the previous chapter, i.e. the anatomy of an EA, its structure, its components and models. Let’s have a look back at the essential features and ask ourselves what benefits we are likely to be able to draw from these.

EA refers to a collection of plans that represent various aspects (data, functions, networks, etc.) at various levels of detail (planners, agents, designers, etc.) in past, present and future scenarios. When we apply this definition to our example of city and house planning, we see that the above-mentioned plans help the various target groups in different ways:

- The planner recognizes, for instance, building gaps, missing utility installations, overly dense development and inadequate structures. The planner can use this as a basis for developing plans and supervising their implementation.
- The agent recognizes missing infrastructure, insufficient capacity utilization, and disadvantageous cost-benefit ratios.
- The designer is able to draw upon experience with earlier plans, identify potential junctions for utility installations, and create uniform facades.
- The builder recognizes the location of utility installations, has access to baseline dimensions and material lists, and knows the location of load-bearing walls.
- The supplier knows the exact dimensions and the expected functionality of the parts that are to be supplied.

EA therefore helps the planner to identify the right application and infrastructure components, to optimally support the fulfillment of the requirements submitted by the business side and to simultaneously guarantee a smooth functioning IT. This requires balancing new projects aimed at fulfilling technical requirements with needs relating to restructuring and optimization. The EA also helps the agent to optimally plan IT investments, i.e. to identify the fields of action with the best cost-benefit ratios. In short, EA helps one to identify the right measures.

The benefits of EA for the builder arise from the creation of transparency with respect to interfaces and relevant dependen-
3.1 The Potential Benefits of Enterprise Architecture

cies, as well as from the detection and management of risks. EA helps one to identify and minimize risks.

**in the right way**

EA helps the designer by providing useful reference architecture models, reducing the cost and effort associated with evaluation, and setting standards. EA helps the supplier to align services exactly to client expectations and guarantee a perfect fit. EA helps one to implement measures in the right way.

Enterprise architecture supports IT management when it comes to doing the right things in the right way at a minimal risk.

**Immediate benefits of EA**

Doing the right things right means guaranteeing the efficiency and effectiveness of action. Security means the absence of risks. EA delivers immediate benefits in precisely these areas:

- IT efficiency: doing things right
- IT effectiveness: doing the right things
- IT reliability: doing things in a low-risk manner

The IT governance process is oriented towards the same goals. EA and IT governance harmonize when it comes to their focus on goals.

IT governance steers.

Enterprise architecture informs.
Figure 3-1 offers an outline of the goals of EA management. The type, priority and character of the goals will vary according to the particular situation. This depends to a large degree on the current situation of the particular enterprise.

Figure 3-1: The Goals of Architecture Management

Figure 3-2 below shows how EA management is oriented towards the fulfillment of three main goals.

Doing the right things in the right way and at minimal risk presupposes knowledge. EA represents a source of this knowledge and is therefore a prerequisite for detecting potential risks, initiating the right (i.e. useful) projects and measures and taking straightforward approaches. This means: generating light for the IT governance process.

Debates about the value of EA, the ROI generated by architecture management, and the associated costs and benefits continue to rage. As always, there are the skeptics who are preoccupied by the business case, there are the analysts and the consultants who present the figures (e.g. HAR2002) and there are the authors and gurus who are convinced that the task of measuring the business value of EA is just as nebulous as the task of measuring the business value of strategic planning (BRO2004).
3.1 The Potential Benefits of Enterprise Architecture

The latter group has received support from authors who are convinced that the value of EA can only be expressed in terms of returns on assets (LOP2002).

This view is formulated by T. Blevins, CIO of OpenGroup, as follows: “Enterprise architecture is a means to an end and the end is about the assets within the enterprise that deliver measurable value. What enterprise architecture does is help you make decisions that are designed to improve the productivity of your business through the effective and efficient use of information technology. When you focus on Return on Assets, it helps you focus on the right things for your enterprise architecture effort.” (BLE2005).

John Zachman, the elder statesman in discussions on the subject of EA, formulates the benefits of EA as follows:

“. . . CEOs declare that the biggest challenge facing the modern Enterprise is change. A quick review of history of all the known...
disciplines that deal with complex objects (things) reveals that change starts with engineering descriptions of the things. There is no way to change hundred story buildings quickly (or safely) without starting with the building plans. There is no way to change Boeing 747’s quickly or (safely) without starting with the product description. There is no way to change automobiles, computers, [...] enterprises, or any other complex thing quickly or (safely) without starting with the descriptive representations of the thing you want to change. These issues of quality, timeliness and change are the conditions that are forcing us to face up to the issues of Enterprise Architecture” (ZAC2004).

Zachman makes clear that EA is simply indispensable when it comes to adapting the complex system of an enterprise's IT support to new conditions and requirements. EA is not an option, but a condition!

Should we rely on the wise advice of the gurus and the proponents of the ROA approach and seek to justify EA in terms of the value of the intangible assets it creates? Or should we seek to make the business case after all, along with the consultants who promise a savings of up to 30%? You, my readers, are right to expect an answer.

In keeping with Theodor Fontane, my solution is: do the one thing and do not omit to do the other. This perhaps overly pragmatic sounding solution is based on an analysis of the potential benefits that we have outlined. The apparent dichotomy of the views expressed by the two authors above arises from a concentration on individual potential benefits.

The representations of EA’s ROI tend to focus on the short-term benefits that can be realized through increases in efficiency and through consolidation measures involving ones infrastructure and applications environment. Here, we can indeed derive heuristics that reveal something about the business case and about the ROI of an EA initiative.

But there are also other factors that promise significant long-term benefits. These provide an answer to those who would insist on judging EA in terms of its return on assets (ROA) and who emphasize enhanced effectivity, alignment, transparency and risk management.

Readers are encouraged to refer to chapter 7 Implementation: Developing Enterprise Architecture for a closer examination of the costs associated with EA and a representation of the cost-
3.2 Optimizing IT Efficiency

Discussing efficiency centers on the notion of achieving a lot at minimal expense or doing more with less. One is concerned to optimize production facilities, work processes, tools, and procedures. Various approaches are taken in the area of IT, including the outsourcing of development and services and the optimization of procedural models, development environments, generators, and software engineering methods. EA supports the optimization of one's applications environment and creates efficiency by enabling one to perform the following tasks:

- Identify duplication: It is important to identify systems that perform largely identical tasks and infrastructure components that have the same deployment scope. Utility arises from the elimination of such duplication or from avoiding such duplication via an effective management of requirements within an EA model.

- Make heterogeneity visible: How many development lines and how many different technologies do we deploy? Is there an acceptable correspondence between this number and the number of systems and deployment areas? Utility arises from the standardization of development lines, the specifica-

tion of reference architecture, from the monitoring of its deployment and from the standardization of infrastructure.

- Analyze interfaces: How many interfaces exist in one's application environment? How are they supported technically? What are the consequences of this for the support of business processes? How is this reflected in one's expenses for applications development and maintenance? Utility arises from the integration of application systems.

- Ensure consistency: What is the scope of special solutions? How often is it necessary to provide technical solution variations? What is the associated cost for development, support, and operations? Here, the utility of EA arises directly from a more effective management of requirements and the elimination of inconsistent solutions.
3 Goals: Doing the Right Things Right

- Support reuse: The prerequisites for a high degree of reuse include standardized architecture and development procedures, homogeneous infrastructure and consistent support when it comes to technical requirements. EA also supports the process of retrieval – a condition for reuse.

Many IT organizations are currently faced by the need to optimize the efficiency of their infrastructure and applications environment. This is put succinctly by M. Lutchen in quoting M. Doane, Vice President of the Meta Group: "Over-acquisition of application software from 1995-2001, combined with a slow economy, has led clients into an era of management and consolidation. CIOs are increasingly in search of measurable business value from what is spent on IT." (LUT2004).

One of the most important initiatives in the area of EA is spearheaded by the OpenGroup, which is currently developing what is known as TOGAF (The Open Group Architecture Framework) in its Architecture Forum. The Executive Overview for TOGAF includes the following description of the benefits associated with EA:

"Better defined structure and modularity in the IT infrastructure lead to a much more efficient overall IT operation: lower software development, support, and maintenance costs, more application portability, improved interoperability and easier system and network management, an enhanced capacity to address critical enterprise-wide issues like security, easier upgrade and exchange of system components. The structure of existing and planned systems is clearly defined, leading to: reduced complexity in IT infrastructure, maximum return on investment in existing IT infrastructure, the flexibility to make, buy, or out-source IT solutions".

The focus of the OpenGroup’s assessment is on improvements in the areas of infrastructure standardization, portability, interoperability, exchangeability, complexity reduction and flexibility.

The U.S. Department of Housing and Urban Development (HUD) focuses its assessment on reuse, standardization and homogeneity. HUD’s website offers the following description of the benefits it draws from EA:

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6 www.opengroup.org

3.2 Optimizing IT Efficiency

“HUD’s EA practice applies existing blueprints to accelerate system design and development. Blueprints are working documents. They define core business processes, common data elements, cross-cutting applications, and standard system platforms. Blueprints are used to verify common system needs that span program areas, and facilitate enhanced communication between program areas and technical staff to define custom requirements. Our leveraged approach means that system design does not start from scratch.”

**Consolidation**

All of these assessments emphasize the importance of reducing complexity, increasing efficiency, shortening development cycles and establishing homogeneity. Consolidation is currently a hot topic. It is used to describe a number of measures, whether these involve the streamlining of infrastructure landscapes that are suspected of being deficient in terms of capacity utilization or excessively heterogeneous, the merging of computing centers and the use of scale effects, the consolidation of the applications environment in the wake of an enterprise merger, or even the alignment of services, infrastructure, platforms and applications in the wake of an outsourcing project. While the Latin consolidate means to make firm or secure, IT consolidation is often associated with ordering, sorting, streamlining, unloading useless freight, creating transparency, documenting and drafting plans – plans of the sort made available by EA.

**The partner of IT governance**

EA represents an instrument of comprehensive consolidation. It provides the plans, references, analyses and documents that you will need to order, streamline, and secure your IT. Moreover, EA does not do this on a one-time basis, on a particular occasion, in the wake of special developments such as an outsourcing project or a merger, it does this continuously and with a sustained impact while remaining firmly anchored in the IT management process as a partner to IT governance.

If you have played a leading role in one of the major undertakings mentioned above (i.e. an outsourcing project, a merger, a project with an impact on the entire applications environment, the development of standard software), then you have probably established (or gone a long way towards establishing) an EA practice. But did you take the further step of securing the result? Was this result then maintained? Was an individual or team charged to assume responsibility for the result? If the answer is no, then you will likely have to start again at some point – from
 scratch. If the answer is yes, then you will likely have a good ba-
sis for what we are concerned to elucidate in this book.

If it is your view that this degree of maintenance is too expe-
sive and will not be worth it, and you prefer to get by without a
continuously updated view of the key indicators for your enter-
prise, then what you are doing is tantamount to driving in the
dark without your headlights! Isn’t it worthwhile to invest in the
proper functioning of the headlights in your car?

Let’s have a look at a case study:

<table>
<thead>
<tr>
<th>Enterprise A decided a few years ago in the wake of a small pilot project to try out an innovative technology that would enable it to successively replace its existing old systems. A new development line known as Java/J2EE was introduced in the wake of the pilot project. An excerpt from the pilot’s shopping and to-do list reads as follows:</th>
</tr>
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<tbody>
<tr>
<td>• Evaluate and purchase tool to support technical analysis and designs, including roundtrip engineering (forward and reverse code engineering).</td>
</tr>
<tr>
<td>• Develop procedural model.</td>
</tr>
<tr>
<td>• Evaluate and introduce test procedure and tool.</td>
</tr>
<tr>
<td>• Evaluate and provide J2EE development and production environment.</td>
</tr>
<tr>
<td>• Introduce Java and J2EE training programs.</td>
</tr>
<tr>
<td>• Develop and introduce integration procedures and tools for host connectivity.</td>
</tr>
<tr>
<td>• Establish database link.</td>
</tr>
<tr>
<td>• Define a change and configuration management procedure for all relevant platforms and acquire tool.</td>
</tr>
<tr>
<td>• Etc.</td>
</tr>
<tr>
<td>It took several months in the context of the pilot project to settle the tasks that were purely a matter of infrastructure. Beyond this, licenses for development tools were procured, training programs executed, and external coaching services purchased. Costs: X1</td>
</tr>
<tr>
<td>The Java/J2EE development line is now operative, employees have assumed responsibility for administering the above-mentioned tools, for supporting the applications developers, and for conducting training programs and offering coaching services.</td>
</tr>
</tbody>
</table>
### 3.2 Optimizing IT Efficiency

The maintenance costs for the development environment and staff costs for its management come in at Y1.

Now, in connection with an outsourced project, our enterprise has introduced a website (an Internet application for clients) and established a .NET development environment. Low and behold, the shopping list is the same as the one above. This development environment was also incorporated in the line. Costs: X2. Costs for the running operation of the .NET development line: Y2.

If one now confers with the experts for the respective development lines, one will discover the following: both claim that they could have handled the technical task involved in the other project with their own development line. At the moment, there is even an element of competition between the two development lines for new projects. Conferring with external experts will also reveal that the two development lines have a largely identical range of application.

Is this a case of duplication? We have more than one cost-intensive technical solution for one application range. An accident? Luxury? Chance?

The savings potential of subsequent consolidation: \( \text{MAX} (Y1, Y2) \)

Cost avoidance via proactive development planning: \( \text{MAX} (\text{MAX} (X1\text{+}Y1), (X2\text{+}Y2)) \).

Unfortunately, this is not a merely contrived example. It is commonplace, it belongs among the standard cases that I have seen when taking inventories of applications environments and infrastructure landscapes.

There are naturally justifications for such outcomes, such as time constraints, limited capacity, and a lack of know-how, to name just a few. Only a wide-angle consideration of all of the existing business and IT factors as well as the project costs and subsequent costs will enable one to arrive at a sound evaluation. A view of such connections is exactly what EA offers.

Virtually all of the as-is analyses of applications environments that I have carried out or become acquainted with following the initial establishment of EA processes in recent years succeeded at identifying at least one application range with redundant development lines. This will come as no surprise, given the fact that one is aware of the existence of redundant development lines. But while it is not necessary to introduce EA in order to bring
such information to the light of day, it is often necessary to
gather the information in the context of EA to show the conse-
quence of such duplication in terms of time, effort and money.
Moreover, the EA reveals the existing dependencies and offers a
sketch of how one might approach the task of consolidation. It
follows that while the introduction of EA was not necessary to
detect redundancy (close examination usually suffices in the area
of development), it was indeed necessary to justify and manage
consolidation. Do you know what the annual costs are for run-
ning a development line? My experience indicates that it is at
least equivalent to the annual costs for 2 employees, plus all of
the associated licensing, updating and training costs.

More than 50% of all of the current-state analyses of applications
environments revealed redundancies, gaps or breaches that in-
troduced an additional (currently non-quantifiable) potential for
optimization.

In connection with the more technical discussion concerning the
issue of EAI, the complexity of application environments with
numerous interfaces has been adequately addressed. The intera-
cction of n components will make it necessary to implement a
number of interfaces \(x = \frac{n \times (n-1)}{2}\) (see Figure 3-3). Reducing
the interfaces to the necessary number goes hand in hand with
the elimination of breaches, i.e. the integration of previously
separate application systems if doing so makes sense from the
viewpoint of business processes.

All of the current-state analyses of infrastructure landscapes that
were followed up by consolidation helped to reduce heterogene-
ity by 10 - 20%. This means that of 100 previously deployed in-
frastructure components, 80 - 90 remained in place after con-
solidation. This led to a reduction in licensing fees of around the
same amount, while potential savings in the area of human re-
sources came in at 5 - 15%.
3.2 Optimizing IT Efficiency

**Nipping heterogeneity in the bud**

The architecture management processes established in programs, projects and boards (e.g. the architecture board) in connection with the introduction of EA handle a further important task: they provide for the continuous monitoring of applications environments, development lines and infrastructure portfolios, and thereby help to make sure that heterogeneity is nipped in the bud.

What is the utility of consolidation? What do reference architecture models do for us? What is the purpose of application scenarios? What are the benefits of EA?

These show us where sand is in the gears, where we are carrying extra baggage around, where we are not going to find the needle in the haystack we have created. In the ideal case in which our EA is continuously updated, these items ensure that heterogeneity is not given a chance to develop in the first place. They provide increased efficiency by getting at the roots of inefficiency. They not only manage complexity with ever new tools, generators and process models, they eliminate complexity or prevent it from ever gaining a foothold.

**Added expense from heterogeneity**

Homogenization via consolidation measures or, better still, the proactive prevention of heterogeneous elements has a direct impact on IT efficiency (see Figure 3-4). Every additional application, every additional standard software package, every new infrastructure component, every additional development line creates additional expenditures that are not directly productive, i.e. for training, adaptation, testing, troubleshooting, integration, etc.

**Continuous IT inspection**

Are we as efficient as possible, or are we burning our superstructure to keep the steamship on course? Are we wearing out our valuable human resources because we have allowed unnecessary heterogeneity to take hold? Architecture management is responsible for the continuous inspection of our IT – are we as fast, as good, as efficient as possible, or are we staggering under the weight of unnecessary freight?
Combining operative and strategic architecture management

The benefits stem first from the combining of operative and strategic architecture management. Only when we succeed at thoroughly implementing the reference architecture models established in the context of development planning, only when an appropriately authorized architecture board has been put in place to ensure adherence to the standards, only when the operative software and systems architects who have been appointed to complete projects recognize the precedence of the established standard over the creative development of ever new solutions to long resolved problems, only then can one effectively prevent the overgrowth described in my example above.

Consider the following assessment of a case study presented by the OpenGroup: "One of our case studies says it all: the strategies embodied in the architecture lead to enormous savings, not in measured terms of hundreds or thousands, but rather millions of dollars. According to a report from Corporate Executive Board Research, John Hancock realized a US$6.25 million savings on redundancies discovered through enterprise architecture. Dow realized US$300 million in new revenue as a result of implementing new projects identified by the enterprise architecture work. And Key Corporation realized 20% reduction in application maintenance resulting in a 1st year savings of US$7 million." (BLE2005).
Effectivity stands for business alignment, or the lining up of IT to the task of meeting business needs, i.e. its concentration on the right projects, the right application systems, and the right infrastructure in a way that generates maximum utility. Those projects are to be carried out that allow one to achieve the greatest utility for the economic and strategic goals of the enterprise. Those application systems are to be optimized that are the most important for enabling one to reach one's business goals. Those infrastructure components are to be purchased and maintained that support the business processes that ensure the greatest creation of value. Optimizing IT with the help of EA entails the following:

- Ensuring goals conformity: Are all IT investments optimally oriented to the economic and strategic goals of the enterprise? Are those projects given priority that exhibit the best cost-benefit ratio? Are exactly those maintenance measures placed up front and center that promise to optimize the application systems with the greatest utility for the business? Do operations units focus their service quality on those areas that are the most valuable for the business?

- Securing strategy and resources conformity: Do one's IT measures and projects converge with one's business strategy? Are the resources that are necessary for the implementation of the strategy provided in a timely manner and according to the budget?

- Placing results orientation in focus: Does one primarily harvest the low hanging fruits? Is one at all times focused on those measures that exhibit the best cost-benefit effects? Has the utility for one's business aims been sufficiently precisely operationalized?

- Ensuring deadline orientation: Are checks run for all measures, projects and line activities to determine what sequence will create the earliest gains? Is there a sufficient focus on the quick wins? As we all know, the early bird gets the worm!

There are many reports available which have been published by organizations that have gathered considerable EA experience. Obligated by law to introduce EA and architecture management processes, many U.S.-American agencies and public organizations belong among the pioneers in this area.
In its Final Report on EA (FET1999), the Federal Energy Technology Center (FETC) describes the benefits of EA as follows:

- “Provides a structure in which FETC can manage its information and processes.
- Ensures that our information and technology support the business.
- Focuses systems development toward organizational needs, not individual desires.
- Leads to improved information quality.
- Leads to more efficient and effective information system development.”

The following assessment of the benefits of EA appears in the Executive Overview issued by the initiators of The Open Group Architecture Framework (TOGAF)⁸:

“It is much easier to ensure access to integrated information across the enterprise: maximum flexibility for business growth and restructuring, real savings when re-engineering business processes following internal consolidations, mergers, and acquisitions, an IT infrastructure much better equipped to support the rapid deployment of mission-critical business applications. Faster time-to-market for new products and services, leading to increased growth and profitability. In short, an effective IT architecture can make the difference between business success and failure. By investing in IT architecture, you are investing in: business success, independence from suppliers, and control over your own destiny”

Time-to-market, support of business aims, IT alignment, flexibility – these are the frequently recurring themes. Many readers may think: difficult to conceive, not really graspable, complex.

If the transparency-creating EA that we have introduced helps us to avoid unnecessary heterogeneity, reduce complexity and thereby secure or increase efficiency, then we have accomplished a lot. But how can we be sure that we are also using the newly acquired efficient means for the right measures? How can we be sure that we are not driving our ultimate efficiency machine at full speed in the wrong direction?

⁸ www.opengroup.org
3.3 Optimizing IT Effectivity

Is portfolio management the answer? My response is that it is necessary, but nor sufficient! How does your portfolio management work? Your department clients outline their projects in the context of an annual plan. All of these projects are evaluated in terms of their strategic and economic significance, the result is pressed into a portfolio, and then a red line is drawn (see Figure 3-5) that is derived from the available IT budget. The same old story. Perhaps the IT division is able to define a few of its own indispensable projects (e.g. network expansion). Perhaps, in addition to this, dependencies between projects are analyzed. Perhaps the departments will be given a budget corridor in advance. In the end, we are always left with the image of the portfolio with the red line in which you can identify all of the projects that are to be carried out in the next year.

Figure 3-5: Project Portfolio

Projects? Yes, projects are listed here. But who is to take care of the applications, the infrastructure, and the existing landscape. In other words, who is to do the housekeeping? While you may indeed introduce your own IT issues, where are these to come from? Out of the blue? Are they independent of the virtuosity
with which you run your business? Do you identify IT projects, the necessary establishment of infrastructure, the smart renovation of existing systems, the optimization of interfaces and the integration of systems by taking a careful look? Do you carry out regular checks of the quality of your applications and infrastructure landscape? Are you continuously on the uptake for development gaps, redundancies, and heterogeneity?

In the end, the housekeeping is even more important than drafting new projects for the portfolio: development accounts for only 20% of the accumulated costs of the average IT application at the end of its service life, the remaining 80% is accounted for by integration and operating costs (PRA2002). These costs must be converted into value-creating investments.

Portfolio management and architecture management are complementary. The one is responsible for the optimal allocation of resources for the new, and the other is responsible for the optimal maintenance of the existing. Why build a new bathroom when the only thing the existing one lacks is a fresh coat of paint?

A simple applications portfolio of the sort developed in some portfolio management procedures is of little help here. While such a portfolio will show us the strategic and economic significance of existing application systems, and may even contain figures on operating, maintenance and production costs, it will offer no basis for a technical analysis.

By way of illustration, let’s consider the following case study:

Our fictitious Enterprise B is an insurance company with a business focus in the Life sector and a significantly smaller Composite sector (Property, Liability, Accident, etc.). A few years after an electronic system for forwarding application data was installed so as to link the sales support systems in the Life sector (which enabled a far more efficient process for moving from an application to a policy), the development of a similar solution for the Composite area came up for consideration.

At the time, our insurance company’s IT was very sector-specific, with separate inventory management and sales systems for the Life and Composite sectors. This contrasted with the company’s hybrid departmental organization, with a common sales unit that handled all products and all distribution channels and an inventory management that was divided along the lines of two executive levels, one for Life and one for Composite.
The project Application Data Forwarding for Composite was submitted to Portfolio Management by Composite Inventory Management, supported by Sales and given high priority. Given that the corresponding system for Life had already been installed, the project faced no competition: the project budget was approved and work on the system's installation was begun.

The project turned out to be more complex than expected. The link for transportation agencies to the motor vehicle insurance office exhibited unexpected particularities that led to project delays and budget overruns. In the end, the application data forwarding system for Composite proved to be more expensive than the existing system for Life, whose reuse did not come up for consideration because both its front-end and backend systems were different from those of Composite. As a consequence, the smaller Composite business unit was outfitted with the expensive solution. The resulting system landscape can be represented as follows:

A short time after the data-forwarding system for Composite was up and running, the actuary department came forward with a proposal for the introduction of new products for the Life sector that promised good business in the wake of new legislation. An emphasis was placed on the swift development of the products and their swift representation in the IT systems. A reduction in time-to-market was the main goal.
In the context of this project, however, it became clear that adapting the data-forwarding system for Life to the new products threatened to hinder the whole project. The tasks of harmonizing the product rules, application and policy structures, the representation of these aspects in the systems, testing and productive operation were far more complex than expected. The task force that was rapidly assembled to analyze the situation came to the following conclusion:

- The sales and inventory management systems for Life were based on different technical models. While the aim in the case of sales support was a pricing and application system with great flexibility, and which led to a generic data structure, the model for the inventory system was established in light of a policy administration characterized by considerable batch processing. The lifecycle consisting of quotation, application and policy had not been carefully thought through in either of the two projects.

- As a result, we were confronted by two entirely different systems, with the electronic system for the forwarding of application data not only functioning as a technical medium, but also as an impedance converter between both worlds. This is exactly why these components proved to be a bottleneck: It was only after both systems had undergone their adaptations to the new products that one was in a position to design the necessary adaptations to the electronic system for the forwarding of application data and to implement the mapping. To do this, however, it was necessary to represent the technical models of both systems, a factor that contributed to a multiplication of the costs.
The establishment of greater integration in the case of sales and inventory for the Life sector (i.e. based on a lifecycle consisting of quotation, application and policy) seemed appropriate. What was called for was a system involving the same models, the same structures, the same rules, the same understanding and, ideally, the same software components:
While this necessary optimization was identified in the context of the later investigation of the relevant section of the applications environment, it was not detected early enough to be included in the planning process.

Portfolio management alone will not permit one to identify all of the important factors. Indeed, identifying the measures that are necessary and that will lead to increased efficiency requires that one take a holistic approach, an approach that includes both the planning of new components and the optimization of existing components. The identification of ways of optimizing the existing landscape should not be left to chance and should not be entirely dependent on the discerning eye of those involved. While this area deserves greater attention and support than portfolio management, it should also be part of an established procedure and anchored in architecture management as a counterpart to portfolio management. The alignment of the project portfolio to the development plan adds an element of security to investment planning, i.e. it will ensure that resources are not invested in the wrong areas.

The establishment of a connection between architecture management and portfolio management represents a prerequisite for doing the right things. This means using portfolio management to select exactly those projects and optimization measures for the applications environment that will bring the greatest utility for
the enterprise. The significance of EA management is growing. Applications and infrastructure are becoming ever more important – more important than projects.

**Return on assets**

This is so because the production factor capital is becoming more important than work: “The world’s markets are currently subject to an immense shifting in the significance of the production factors work and capital. In the meantime, entire regions of the world [. . .] have reached a level of development that permits hundreds of millions of people to offer their labor services on the global market from these regions. This coincides with a high demand for capital throughout the world. An increasing supply of labor tied to an increasing demand for capital? It follows that the cost of labor will decline while that of capital will rise.” (MUL2005)

The consequence: capital must create value, return on assets has become crucial. Gartner draws comparisons here to production (LOP2002). While the declining number of employees in the manufacturing sector in the United States was initially tied to the transfer of production facilities to low-wage countries, one was forced in the end to recognize that the manufacturing sector’s share of the gross national product remained constant. Fewer employees and constant value creation. Gartner explains this in terms of increasing returns on assets and draws a comparison to IT:

“Using manufacturing as a guide, the case for investment in enterprise architecture now rather than later is based on two points:

- **ROA.** IT infrastructure is the platform for long-run productivity. The right planning now will assure the opportunity to see improved operating results in the long-term. Growth in ROA is a metric that can be used to justify a growing market capitalization.

- **Return on opportunity.** While not a formal financial metric, return on opportunity describes the impact an investment has on the business. The process of taking a new business concept - such as a new business model, product, market or process - must overcome constraints that are built into today’s business structures.” (LOP2002).

It follows that IT applications and infrastructure represent the assets of ones IT division that are gaining in significance compared
to project investments. Housekeeping (i.e. the maintenance and optimization of applications and infrastructure) is the task of the day.

3.4 Optimizing IT Security

What follows are a number of examples that characterize the absence of IT security:

- A project requires unexpected infrastructure components, additional servers, increased network bandwidth and associated budget overruns.
- The decision to switch to a new programming language has consequences: test tools, CCM tools and staff training programs become necessary, the development of the GUIs requires the purchase of a framework and costs explode.
- A project fails to progress on schedule and exceeds the budget.
- The changeover of workstation computers to a new operating system version leads to downtime.
- A misguided project decision leads to the establishment of an additional, essentially superfluous development line.
- Properties that were to be assured in the context of the project (e.g. scalability, security, availability) fail to materialize by the time of the productive start.
- The interaction between the user helpdesk and 2nd-level support is deficient; the users express dissatisfaction.
- A project goes into production despite unsatisfactory performance.
- Etc.

Reports of such failures appear in the press. Have you ever experienced or had to endure such a case? The failures mentioned constitute risks that could have been avoided. When approached properly, EA and the processes of architecture management represent security measures. They reduce the probability of failure and thereby offer security. While such security costs money, it would nonetheless be reasonable to ask ourselves what we are prepared to pay?
3.4 Optimizing IT Security

We need security because we, in contrast to our colleagues in the construction sector, work with new procedures and building materials for which no heuristic techniques have been developed. We venture into uncharted territory and are therefore required to bring emergency rations along with us, perhaps more than are really necessary.

How do failures of the sort mentioned above occur? A few of the many reasons include: lack of experience with new technologies, insufficient planning, incomplete assessments of all of the necessary aspects, insufficient testing, and the illegitimate and careless application of experience gained in other areas.

If they have been properly calibrated, architecture management processes will contain numerous instruments that allow one to create a greater degree of security when it comes to the development and provision of software and the effective prevention of such failures both in the area of strategic planning and in the area of operative implementation. These instruments include:

- Checklists that help software architects to analyze critical influence factors
- Formal specifications for architectural structures and contents that ensure completeness
- Checklists that help software and systems architects to achieve proper infrastructure design
- Early warning indicators that let one know when certain threshold values have been exceeded and when countermeasures are to be deployed
- Reference architecture models that have been tested for reliability and for which measurable heuristics have been developed
- Process sequences that specify stress tests and require their application in situations of doubt

A case study:

Enterprise X initiates a major project to replace its core application system that currently supports around 80% of the business. The old application is based on a large computer system with a large degree of batch processing. The system is to replace the functionality of the old system, support new products and provide for the integration of new functions, including workflow and document management.
The project begins with a technical analysis and the development of a GUI prototype in consultation with the individual departments. A decision is made to realize the new system for object orientation in client-server technology. The GUI prototype is completed just as the work on the technical analysis is being brought to a close. A decision is made in favor of a framework that is also to support GUI development. In the meantime, roughly 60 employees are working on the project. According to the plan, this number is to be increased to roughly 100 employees for the subsequent realization.

The organization for the project during the realization phase has been established, the relevant heroes have been found. Questions relating to further planning are posed by staff at work on subprojects:

- How are we to handle the batch processes, has this been checked by the prototype?
- How are we to handle the link to the applications environment, the interfaces to Cobol systems, and the connection of new GUIs to existing 3270 screens?
- For the sake of simplicity, the test data for the GUI prototype are stored on a DB2 server. How are we to handle the client-server architecture in actual operation?
- How are we to handle the new workflow system in connection with our GUIs?

A decision is made to appoint a task force to address the unresolved questions. The task force begins its work by drafting an architecture plan. This results in a measures catalogue including around 150 measures. Figure 3-6 below shows an excerpt of the catalogue.

The measures catalogue then becomes the basis for a new subproject whose purpose is to rapidly provide the basic components for the development environment, standards and infrastructure so as to ensure that one does not fall behind the pace of the work on design and realization - an example of a response made just in time.
The case study on the subject of security clearly illustrates how elaborate technology selection processes can be, and how much time we need to equip ourselves in order to get projects involving a considerable degree of new technology and/or a major impact on the entire applications environment set up. Defined architecture management processes, checklists, methods, evaluation procedures are very helpful when it comes to minimizing these set-up times (see Figure 3-7).

Figure 3-6: Measures Catalogue for Software Architecture
EA creates transparency and order and enables us to carry out analyses of potential risks. The processes of architecture management include mechanisms of risk management for your entire IT - benefits of which one is probably sufficiently aware.

However, as compellingly outlined by Tom DeMarco and Timothy Lister in their book *Waltzing with Bears*, risk management is a rather unpopular subject in the IT field (DEM2003). It therefore comes as no surprise to me that the benefits aspect of security receives little credit in current discussions of EA.

Active risk management leads to an increase in security. This requires investments, not least, for the identification of dependencies and points of impact that can be the sources of risk. EA creates the necessary transparency, supports risk management and lowers ones inhibitions (compellingly reported by DeMarco und Lister) to undertake risk management (DEM2003). Given that security may conflict with efficiency, one is warranted in singling it out as an independent goal. Risk detection is often a time-consuming process - the more transparency we create out of the box with our EA, the easier it will be to establish risk management.

Security is primarily achieved via transparency: the more open the terrain (i.e. the more transparent our EA), the more secure we will be as we move about inside of our projects and other measures. Risk and uncertainty grow in the dark.
Security entails an absence of risks and becomes perceivable and measurable via compliance with established standards that describe familiar territory in which risks are managed or at least highlighted. Such standards may be of a technical nature (standardized infrastructure, reference architecture) or they may be business-related: rules of compliance that account for laws such as the Sarbanes-Oxley Act (SAR2002) and the Sharma risk maps from Solvency II (ZBR2004).

EA increases security in that it provides an effective means of risk management for IT projects. EA not only makes hidden points of impact and dependencies transparent, it puts one in a position to treat the risks that are associated with them. Wouldn’t it be nice if you could generate an individual playing field for all of your projects: enterprise and IT goals to be supported, affected and/or contributing organizational units, business processes to be supported, affected software components and interfaces, infrastructure components and platforms? Such information makes for a more secure decision making process, it enables active control, and is the basis of IT governance.

EA enables one to measure connections and thereby to gather and act upon data – yet another contribution to active risk management. It is not for nothing that the framers of the Clinger-Cohen Act (CCA 1996) in the United States provided for the adoption by federal agencies of rules applying to IT management, rules which subsequently formed the basis for the development by these agencies of extensive EA programs. The lawmakers involved were operating on the assumption that EA would generate clear benefits, make an important contribution to improved IT security and risk management, and facilitate the establishment of genuine IT governance: “CCA (Clinger-Cohen Act) emphasizes an integrated framework of technology aimed at efficiently performing the business of the Department. [. . .] the Department also cannot operate efficiently with hardware and software systems purchased on an impulse purchase basis and installed without an overall plan.”

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9 From the website of the Department of Education (www.ed.gov)
3.5 The Goal: Illuminate the Dark

The goal of an enterprise architecture (EA) initiative can be summed up as follows: doing the right things right, for instance, by enhancing security. What is the purpose of EA? We want to light up the dark, create transparency and establish an instrument of navigation for the management process. We want to straighten things up. We want to exercise governance.

In the year 2003, the IT Governance Institute conducted a global study involving 7,000 respondents and supplementary interviews with 276 CEOs/CIOs.\(^{10}\) The results of the study include the following statistics:

- More than 93% of the top managers surveyed indicated that IT plays an important role in the implementation of enterprise strategy.
- Only 7% of those surveyed indicated that their organizations experienced no IT problems during the previous year.
- More than 80% of IT executives surveyed indicated that it was necessary to implement IT governance or parts of such a regimen to solve current IT problems.

The study results indicate that while IT governance is perceived as highly significant and necessary, the rates of its actual implementation are low. Why is this? The ITGI highlights the COBIT process model as an instrument for the implementation of IT governance. But is it the processes alone that we are missing? Is it not much more a matter of our information basis, the lack of a management information system for the CIO or, in short, the lack of analyzable EA?

EA creates the transparency that is necessary for effective control, it reveals hidden dependencies and points of impact, it helps us to appreciate how goals, products, business processes, application systems, platforms, infrastructure components and equipment are joined to one another. It lightens the task of quickly detecting at the start of projects what factors will have to be taken into consideration, where it will be necessary to intervene, where it will be essential to adapt interfaces, revise product definitions, reformulate help texts, and set up infrastructure.

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\(^{10}\) [www.itgi.org](http://www.itgi.org), 12.3.2005
3.5 The Goal: Illuminate the Dark

EA represents an information system, a data warehouse, i.e. the management information system for the CIO! It contains the essential information for planning, for organizational tasks, for guiding and controlling the IT unit. This makes EA the backbone of IT governance. Navigation that is not based on analysis is risky. Analysis without sufficient documentation is also risky.
How do I know, what I think, before I hear, what I say.

The classic definition of management is based on the assumption that things can be moved by systematic action, by a controlled circuit of planning, organization, control and navigation. As we are all aware, this presupposes information. How are we to plan, organize, control and, above all, navigate if we do not know where we are and where we would like to go? Any form of management is based on information, irrespective of whether it is a matter of our sales information system that enables us to direct sales activities and product development or our business intelligence suite that gives us an overview of all of the relevant indicators. If we would like to achieve a state in which things simply work, then we will have to actively manage development. This cannot be done in the dark.

As trivial as these observations may sound, one still often encounters a lack of the transparency that is necessary for the intelligent management of complex (and expensive) development and operational processes in the area of IT. Points of impact and dependencies are not transparent and are not detected on time. Weaknesses remain concealed and potential is left unexploited. Enterprise architecture (EA) can help here as the management information system that is an indispensable tool for the CIO. It is the place of convergence for the relevant information, including information about strategy, business, application systems, infrastructure components, and projects.

In the present chapter, we will concern ourselves with the issue of what an EA model is to look like, what information it is to contain, how detailed its structure is to be and what we will need to form it into a real foundation for lastingly effective IT governance and professional IT management. How do we develop and document business architecture? What terms do we use to describe software architecture? What are the elements of systems architecture? How does one administer EA? How are we...
4.1 Anatomy of an Enterprise Architecture Model

There are many approaches to structuring EA models. These essentially distinguish themselves in terms of the number of architectural levels they involve, the demarcation of these levels and their granularity. I will proceed according to the keep-it-simple principle and make use of a generalized and simplified structure. While there will be ample occasion for refinement, let us first concentrate on the essential elements that are relevant to decision making and management in the context of EA.

The basic structure of EA can be represented by three main levels. These correspond to the levels shown in the EA pyramid and may be restructured as necessary:

- Business architecture
- Software architecture
- Systems architecture

Figure 4-1 below offers a representation of the three main levels with their respective elements:
### 4.1 Anatomy of an Enterprise Architecture Model

<table>
<thead>
<tr>
<th>Business Architecture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goals, Conditions, Strategy</td>
</tr>
<tr>
<td>Processes</td>
</tr>
<tr>
<td>Components</td>
</tr>
<tr>
<td>Organization / Location</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Applications Architecture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application Systems and Components</td>
</tr>
<tr>
<td>Data</td>
</tr>
<tr>
<td>Interfaces</td>
</tr>
<tr>
<td>Layers</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Systems Architecture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development Environment</td>
</tr>
<tr>
<td>Test Environment</td>
</tr>
<tr>
<td>Integration Environment</td>
</tr>
<tr>
<td>Inspection Environment</td>
</tr>
<tr>
<td>Production Environment</td>
</tr>
<tr>
<td>Hotfix Environment</td>
</tr>
</tbody>
</table>

**Figure 4-1: A Basic EA Model**

**KISS - Keep it simple and smart!** Further levels or sub-views often mentioned in the literature include security, information, data and integration architecture. These further components of EA can be appropriately assigned to the basic model shown above. Experience shows that complex EA models tend to generate volumes of data that are difficult to manage when it comes to using the architecture for purposes of analysis and planning. While such complex models may be accurate, they are, practically speaking, useless. A simple, appropriately compressed top model that draws its substance from concealed and more detailed layers is far more suitable for our purposes.

**Relationships form the basis of analysis** It will be necessary to extend the levels in our model through the inclusion of references that will help us to draw cross references. These references will be assigned to the applications environment in our model. This environment is thereby void of content (and accordingly does not qualify as an independent archi-
tecture level) and merely plays the role of linking the contents of the architectural levels to one another and thereby creating the essential basis for EA analyses.

Anchorage points will be needed for the establishment of references between the levels. The software architecture level in the model contains services that are offered to support the business and that permit a connection to goals, business processes and organizational structure in the business architecture.

The software architecture in the model is divided into two levels in order to support the link to operative implementation (see Figure 4-2). The upper of these two levels is reserved for application plans that are platform-independent. Examples of such models include technical concepts, concept class or data models, activities diagrams, and status machines. The Object Management Group (OMG) refers to this layer in their model-driven architecture as a platform-independent model (PIM). The lower of the two layers contains technical items and application models that are platform-specific. Examples of the elements in this layer include design models that are dependent on specific programming languages and technical data models. The OMG refers to this layer as the platform-specific model (PSM). This layer is given its content in the context of operative architecture management (see 7.3 Establishing Operative Architecture Management).

Given these extensions, the application environment will now allow us to create references that will enable us to represent the support of aspects in our business architecture (e.g. business processes) via aspects in our software architecture (e.g. applica-
4.1 Anatomy of an Enterprise Architecture Model

tion systems) with the use of aspects in our systems architecture (e.g. platforms). The references represented in the applications environment (see Figure 4-3) enable us to answer questions such as the following:

- Which application systems support the business process new business, which platforms and infrastructure components are required for this task and what are the associated costs?
- What will be the consequences of replacing a specific infrastructure component or an application system (e.g. an obsolete operating system or a standard software package whose maintenance is to expire)?
- What are the consequences for the business of shutting down an application or database server?
- What impact will the progress of a major project have on the expansion of the infrastructure? What additional infrastructure components will have to be procured? What hardware? What additional sources of stress will arise for the existing hardware?
- How frequently were business processes transacted in the past? What quantity structures (transactions, database inquiries, and data volumes) resulted for IT? How did these quantity structures develop over time? What was the associated cost?

The elements of the EA that are linked to one another via references will have to be given attributes if we are to arrive at answers to these questions. Information about the costs and risks associated with the shutting down of an element (e.g. a server) or about required and available memory is necessary, for instance, in order to evaluate the references shown in Figure 4-3.
In addition to the cross references between the levels of our EA, we are also interested in references to requirements:

- What requirements are met by the application system Partner?
- What requirements does the application system Partner generate for other systems?
- What requirements are mutually dependent or conflicting?
- What technical requirements are met by the components in the software architecture? What infrastructure and hardware components also play a role? What would be the consequences of a hardware or infrastructure breakdown?

Figure 4-4 offers a view of the entire EA, including the referencing mechanisms and requirement references:
This overall view of the EA is populated by numerous individual plans that can be assigned to the various sub-regions (here symbolized by boxes). There are process models, organizational models, data models, and network models that have been aligned to one another and that can be comprehensively evaluated. The following example offers us an illustration of a process model that is integrated in the EA.
The contents of the three main levels can be compiled into views via the creation of excerpts or abstraction levels in order to accommodate the needs of specific stakeholders for information. For instance, specific project sections can be represented that compile all of the aspects of the EA that are relevant to a specific project in a single projection. Such views are helpful and necessary both for projects and line tasks (e.g. network optimization), task forces and planning support (see Figure 4-6).
4.1 Anatomy of an Enterprise Architecture Model

In addition to projections for specific purposes, abstract views for the various stakeholders (planners, owners and developers) are also necessary. Given that these stakeholders may have very different information needs, one is required to make the models viewable in different representations. For instance, company planners will need to see abstract views of an applications environment, while project managers will need to visualize the progress of their projects and designers will require an even more detailed view of the same (see Figure 4-7).

One may refer to the Zachman Model when it comes to structuring the various levels of abstraction and topics that are of interest to the EA stakeholders (ZAC1987). The lines in the Zachman Model (see Figure 7-13: The Zachman Framework (from

Klaus D. Niemann, From Enterprise Architecture to IT Governance, ISBN 3-528-05856-0
All Rights reserved. Friedr. Vieweg & Sohn Verlag / GWV Fachverlage GmbH, 2005
AGI2004), p. 191) describe the specific views for stakeholders, including planners, owners, designers, developers, and suppliers. Following the Zachman approach, our basic EA assumes a third dimension when we seek to represent the various views and levels of abstraction for various stakeholders. Each of the views contains a specific abstraction or projection. In contrast to the Zachman Model, we now assume an open number of such views that may arise in relation to the particular situation in order to meet specific documentation, analysis or planning needs. The view arises as a projection or abstraction from a copy of the basic model (see Figure 4-8).

Figure 4-8: EA: The Big Picture

The big picture that is derived in this manner from the EA and the compiled and consolidated plans it contains gives us answers to the following core questions:

- What is supported by IT systems?
- How is this support realized?
- What is used to realize this support?
- What costs are incurred? What are the benefits? Where are the gaps, breaches and redundancies?
4.1 Anatomy of an Enterprise Architecture Model

- Why are IT systems deployed? What business cases are at stake? What requirements form the basis of the system?

The plans that are contained in the business architecture are to be used to represent exactly what is supported by the IT. The business architecture contains business process models, organizational models, specifications of enterprise goals, IT objectives and basic conditions, and models of business components. This architecture thereby offers a description of how the business functions, not only from the viewpoint of IT, but with an eye to the aim of the EA, i.e. the design of the enterprise’s IT landscape.

The software architecture is to answer the question as to how the business is to be supported. The software architecture contains models of software components (that are aggregated into application systems), data, interfaces and layers. Following the OMG approach of model-driven architecture, these models are sorted out into platform-independent models (PIM) and platform-specific models (PSM) in order to separate model views that contain implementation-specific details (e.g. the API of a specific application server) from model views that are platform-neutral.

The system architecture is to be used to document what is used to operate and support application systems. The system architecture includes models that describe infrastructure components (e.g. operating and database systems) and equipment types that are made available in various environments to serve as a sequence environment for application systems. Environments used for development contain different infrastructure components and equipment types than, for instance, testing or production environments.

The referencing that is made available by an application environment tells us what application and infrastructure systems support the business. The applications environment is a collection of references that shows us, for instance, what particular application systems support what particular business processes though the deployment of what particular equipment types and infrastructure components. In defining the EA model, we made no provision for an independent architectural level to handle this case because our model allows us to represent all of the relevant details via referencing. This referencing allows us to evaluate our EA: What costs are associated with this support? What benefits? Where are the gaps, breaches and redundancies?
What is the purpose of it all?

The requirements specifications tell us what purpose is fulfilled by the deployment of IT systems. These specifications contain references to requirements:

- Requirements that have an impact on the implementation of software components
- Requirements that are to be met by the infrastructure in connection with the deployment of software components
- Requirements that are met by the provision of pieces of equipment
- Requirements that form the basis for other requirements
- Requirements that conflict with other requirements

Administrative mechanisms are necessary for the long-term use of EA. These mechanisms enable one to breathe life into EA and to exploit its potential for facilitating planning activities and the drafting of analyses. Assisting in the process are mechanisms for historicizing, versioning, and creating slogans, excerpts and abstract views.

- Historicizing helps one to maintain and represent the past, present and future states of one's EA. Variance or gap analyses help one to determine the delta between current and target states and to derive measures from and ultimately control this variable.
- Versioning helps one, for instance, to administer and analyze various planning scenarios for a future state of the EA.
- Creating slogans helps one to navigate within one's EA.
- Creating excerpts and abstract views helps one to draft special views for the various stakeholders.

EA administration

Now that we have painted a picture of what EA is, I would like to take a closer look at the various components. It warrants bearing in mind in this regard that each component, whether it is a matter of the business, the application or the system architecture (or even the requirements and the applications environment references), can be represented, historicized, and versioned in varying degrees of detail in excerpts. While a more abstract view will generally suffice for strategic architecture management (i.e. for strategic planning, the support of IT governance, the capacity to make informed decisions), each part of the EA can be given
greater detail until an operatively implementable model arises that can be deployed as a guideline in the context of operative architecture management for the steering of initiatives and projects. The EA mechanisms that serve in the process of transforming strategic visions and plans into operative reality - and that ultimately represent a condition for the continuous interoperability of business and IT - will accompany us throughout this book.

### 4.2 Business Architecture

Business architecture is a collection of plans that describe the business of an enterprise. The breadth and depth of these plans are tailored to the aim of specifying (in the form of a model) all of the aspects of the enterprise that are relevant to the establishment of suitable IT support. Structural organization, business process models, goals, basic conditions, strategies - all of these are parts of business architecture. Business architecture is developed to optimally align an enterprise's IT support to the fulfillment of basic conditions, the implementation of strategies and the achievement of goals.

In addition to this objective, the plans compiled in ones business architecture can also be used separately for purposes of enterprise planning and development (business development). The visualization and documentation of basic conditions, strategies and goals represents an asset for the enterprise. Comprehensive business architecture models will therefore contain aspects that are relevant to those unversed in IT matters and will reflect operational reality in the form of models.

However, before embarking on the remainder of our journey through the territory of EA development and use, I would like to concentrate on the use of business architecture to bring about an enhanced alignment of IT to business processes. This, after all, is our primary concern, not the structure of an enterprise model. Here, again, a rational approach to things is the order of the day. The models assembled in ones business architecture do not arise out of an interest in accumulating facts or a desire to behold their elegance. They arise in the context of a planning process whose aim is an optimization of the IT support for ones enterprise. They begin with the establishment of enterprise goals. They are strategy-driven and they are a part of a plan.
What models do we then need to sufficiently fill the aspect of the business architecture in an EA model? The following are indispensable:

- A model of the enterprise and IT goals
- An organizational model (organizational units, business divisions)

Of equal importance is a business process and product model, which, while it does not necessarily have to be worked out in detail, does have to have been appropriately approved. Exactly this is the pragmatic basis for clarifying the issue as to how detailed the business process model is to be. Further EA modeling ends as soon as a level has been found that offers enough detail to enable consultation and consent. Further refinement of the business process model may then be undertaken in the context of other projects. This is the exact procedure whenever a business process model is already available. This, too, is not incorporated into the EA as such, i.e. including all of the details, activities and descriptions of roles. No more than the top processes and the most important products are necessary to arrive at a technical structure for the EA and an evaluation of IT support.

A business component model offers an outstanding foundation for technical development planning. The essential benefits of such a model include the structuring of application systems and the introduction of a definition of the required technical services. Beyond this, a business component model offers a methodologically ideal means of measuring depth when creating business process models that can either expand upon or replace the above-mentioned pragmatic method. Business processes are further refined until the services that are necessary for the support of sub-processes can be clearly assigned to a business component (see Figure 4-9). The example below depicts the approach to refining the business process Manage inventory until the sub-processes (Find partner, Find product) can each be clearly assigned to a business component. It thus turns out that the level of the business process model found in this manner can be meaningfully deployed in the context of ones EA.
4.2 Business Architecture

The models in the EA should not be developed to a greater level of detail. Business architecture should include the essential technical specifications for the design of the IT landscape and it should be concrete enough to serve as a basis for development planning. However, it should not reach the level of detail that is reached in the case of project models.

**Too many details**
Models that include too many details will be difficult to keep up to date at a reasonable expense. Every change in the details of the target model, the organizational model, and the process and component models will have to be taken into account. On the other hand, a model that is too abstract will not meet the objectives that we are pursuing with the business architecture model in the context of EA. A qualitative and quantitative evaluation of measures (e.g. for development planning) presupposes sufficiently detailed target and organizational models, and reference architecture models must be aligned to deployment scenarios that refer, for instance, to the units in a process/product matrix. It is therefore important to balance these two considerations when establishing a level of detail for the models. Decisions here are often preceded by excessively time-consuming discussions among architects.

**Consolidating models**
What is lacking? A clear definition of the necessary degree of abstraction requires a depth indicator and this, in turn, requires that one take a holistic view of the various models. This is precisely
what many organizations neglect to do. Business process and organizational models are developed and maintained by organizational units. The model of the enterprise goals is the responsibility of the business development unit. Business component models are created in the IT unit. Attempts are usually not made to harmonize the resulting models. This alignment or consolidation is the main task of the enterprise architect when going about EA development and maintenance tasks. The process of harmonizing process and component models outlined above also enables one to determine the proper level of detail for one's models.

**IT is subordinate to business.**

IT is subordinate to business. While this is not an especially original statement, skeptics may protest that I am being overly academic when I suggest that one take the further step of codifying this business in a model, to formalize the necessary activities in a process model so as to make them reproducible and controllable. If we develop the business architecture as something that is an end in itself and if we remain content in the awareness that everything has been properly recorded and documented, then we may have to concede that the skeptics were right.

**A sense of obligation**

Why should we develop a model? What is the purpose of drafting such a record? The answer is that we want to understand the subject matter better and keep ourselves informed. Beyond this, however, we want to create a sense of obligation, a sense of obligation that follows from the written word. A business architecture that is properly aligned and that reflects a suitable level of detail offers us an obligatory code for planning and realizing an applications environment. An obligatory code is of overarching importance at this juncture because any development plan, any reference architecture, any set of infrastructure standards for systems architecture, any architectural draft of a project will be called into question if the business architecture begins to falter.

**Moving targets**

Many may find cause at this point to object – in particular, those who complain vehemently at IT seminars and workshops about the mercurial wishes of their clients on the business side. Indeed, the business departments are notorious for setting up moving targets. On the other hand, I have never come across a case in which a business department changed its objectives for the sole purpose of making life difficult for the IT staff. Naturally, there are often problems of style and timing, but I have never encountered cases in which changes were entirely arbitrary. There is always some important factor involved, for instance, the need to
respond to market developments, account for legal changes, or enter a new market.

Is it at all possible to establish binding conditions when one simultaneously accepts continual change? It is indeed, but on condition that the applicable specifications always possess a period of validity (from/to) and that one’s processes account for change as a permanent feature and place a premium on agility and flexibility! Agility is a crucial factor for the survival of the process used to develop one’s business architecture. Agility is a condition for survival in a highly volatile environment.

The development of business architecture as a component of one’s EA should not be pursued as an end in itself, but as something that will serve as a basis for analysis, planning and implementation. It will be necessary to focus on the alignment of IT and business and to answer the questions that arise in this context. We document business processes in order to be able to analyze the application systems and platforms that have been deployed to support these processes, for instance, with respect to the ascertainment of technical requirements, heterogeneity, costs and benefits. We document enterprise and IT goals in order to be able to investigate application systems in terms of their contribution to achieving these goals. We draft strategies and outline basic conditions in order to be able to identify potential improvements and implement optimization projects. However, without business architecture, we lack the necessary standards for evaluation. We document and analyze without really being able to evaluate our findings and to convert these into concrete action.

The following statement applies no less to business architecture than to all of the other components in one’s EA: If it has been created for the sake of presentation alone, as a kind of show-piece, then no matter how much short-term admiration it might inspire, it is destined to do no more than gather dust and to be forgotten much sooner than one thinks.

As mentioned in our discussion of the definition of EA, the mere documentation of EA will give one a means of determining one’s position. However, these means will remain worthless if one does not initiate the entire EA process. Just as with all of the other EA components, it will also be necessary to use the business architecture. It must be used as a basis for analysis and
planning, as a standard of evaluation, as a guideline for optimization projects and, not least, as an active means of communication and consultation between business and IT. Just as an applications environment that is not linked to the business remains a mere technical construct that cannot be evaluated in terms of its performance and offers no basis for managing future development, so too are similarly unconnected parts in one's EA.

The reason why I endorse the development or integration of business architecture in one's EA is that it will enable one to establish truly sustainable processes of IT optimization. The necessary resources for the establishment of business architecture are usually in ample supply in most organizations:

- Business process models
- Enterprise strategies
- Strategic plans drafted in the business departments
- IT strategies
- Protocols from workshops with executive managers
- Business component models

Using these sources in the context of an initiative to establish EA is usually neither a complicated nor an especially time-consuming matter. The prerequisites include a pragmatic approach, a grasp of the relevant issues, a clear orientation towards the aims of one's EA and a willingness to get things rolling.

Figure 4-10 below offers an overview of a business architecture metamodel (ACT2004). The metamodel shown supports several levels of abstraction (levels A, B, and C) in order to adequately account for both the strategic and the operative orientation of the EA.
Figure 4-10: Business Architecture Metamodel (Level B)
4.3 Software Architecture

The software architecture represents a map of the enterprise’s existing application systems, their internal structure, the technical components they are comprised of and the principles according to which they were constructed. The software architecture tells us the following:

- What application systems and services are used to support the business
- What costs and contributions to value creation are associated with this support
- What availability and reliability these systems offer
- What interfaces and channels of communication exist between the systems and how these are realized technically
- What technical information and parameters are necessary for this technical realization
- How the systems are divided into subsystems, modules and components
- What data they use

It is necessary to develop the software architecture for compliance with the requirements, the business architecture and the principles of EA. In virtue of its operative design, software architecture establishes the principles according to which software systems are developed. It defines the construction of modules and components, it specifies the way in which interfaces are developed, and it defines layers, control flows, channels of communication and procedures for the linking of user interfaces. Software architecture describes the principles of batch processing, session handling, transaction security and application restarts. Software architecture describes all of these items with an eye to requirements pertaining, for instance, to security, stability, availability and performance reliability. In the case of existing application systems, this information is provided in the software architecture.

All of these items come in various forms. Software systems can be structured in 5, 6 or even 7 layers. Components can be derived technically or on the basis of user-specific concerns. Communication can run synchronously or asynchronously. User interfaces can be monitor or symbol oriented and designed graphi-
4.3 Software Architecture

cally or in HTML format. Would you like to hold all options open for every project?

**Heterogeneity**

Doing so will lead to heterogeneity: the application of the various principles according to which software systems might be designed requires expertise, i.e. trained software developers who are capable of working according to these principles. This application requires a knowledge of the accompanying development, testing and production environments. It will have an impact on the infrastructure and system operations.

**Putting up barriers**

Virtually no enterprise can handle the complexity and shoulder the costs of holding all options open, i.e. supporting all conceivable principles and mastering all possible software architecture designs. Here, it is helpful to put up barriers, make determinations and rule out options. An even better approach is to define reference architecture models.

**Reference architecture**

While some may object to the use of the plural here, there are usually several reference architecture models for any given organization. While working with larger organizations, I have never encountered a real-world example of a target architecture model that has a single reference architecture model. The business scenarios that form the basis for systems development and the requirements for back-office systems, mobile sales support, web applications, production management and optional systems are simply too diverse. It follows that several reference architecture models are necessary. A complex enterprise can seldom service all business fields, all products, and all sales channels with a single reference architecture model. Indeed, instead of trying to hold all development options open, it is better to deploy a set of defined reference architecture models that are aligned to the business!

**Deployment scenarios**

Each reference architecture model is then tied to a single deployment scenario (e.g. the support of the mobile sales force, the development of Internet ports, and the provision of services for the back office). A reference architecture model describes a technical solution pattern for a deployment scenario and defines the principles according to which application systems are to be developed or provided in an enterprise to support precisely this deployment scenario. The term architecture domain is also often used in order, from a technical perspective, to stake out the field in which the construction principles, which are necessary for a specific deployment scenario, are specified in a reference architecture model (see DER2003, p. 49ff.).
How does one identify deployment scenarios? Many organizations do this by feel, i.e. they use a good understanding of the user applications to generate the requirements that are to be met by the IT. It is often helpful to have access to the organizational structure of the relevant departments. One procedure for methodically deriving the deployment scenarios is based on a juxtaposition of your enterprise’s top processes and products. It can be very easy to stake out and analyze areas for deployment scenarios using this matrix. We will take a closer look at this procedure in Chapter 6, Planning: Creating Enterprise Architecture.

The most effective instruments when it comes to convergence include deployment scenarios and reference architectures. The step-by-step convergence of business and IT and the reduction of heterogeneity and complexity presuppose a governance whose jurisdiction extends to the operative level. Those items that are defined as strategic in a development plan are operatively implemented with the assistance of reference architecture models. The use of deployment scenarios and their accompanying reference architecture models in this process enables you to create the basis for compliance checks.

A reference architecture model provides us with construction plans for new systems. It delivers the construction pattern specification for software systems and defines, for instance, principles for the creation of components and layers, interface and communication channel designs and the linking of surfaces. When defining such principles, one may refer to patterns for the development of software, with a reference architecture model itself being a pattern for the design of entire systems. Such patterns also include ascertainments concerning the development technologies that are to be deployed and the relevant set of infrastructure standards in the system architecture (see Chapter 4.4, Systems Architecture).

The reference architecture is a part of the complex diversity of all imaginable principles for the design of software systems. Naturally, a reference architecture model thereby also limits both the expertise required and the heterogeneity of development, testing and production environments. Assuming that they are binding in nature, reference architecture models make an important contribution to securing the efficiency of applications development and provision.
4.3 Software Architecture

**Deriving reference architecture**
Reference architectures are not developed in an ivory tower. They are typically developed (e.g. when introducing an architecture management) on the basis of the development lines available within the organization. I use the term development line to refer to construction principles, development tools and infrastructure components that are deployed in a project, an application system or a group of projects or application systems. The existing development lines are investigated with respect to their common construction principles, common technologies, and also their differentiating criteria.

**Reference architecture models require empirical data.**
The derivation of reference architecture models from development lines is necessary because reference architecture models require empirical data. Without these heuristics there can be no reference architecture! We need these empirical data to check architectural drafts, to select the right reference architecture for concrete tasks, and to enjoy the benefits of an early warning system when threshold values (e.g. with regard to transaction rates and availability) are exceeded. However, we also need these heuristics to extend the force of governance as far as operative implementation. Compliance checks are based on such empirical data.

**Development lines**
Figure 4-11 below depicts three deployment scenarios assigned to existing projects and application systems. In the case of technically (user) defined deployment scenarios, we find several development lines, a situation that seldom occurs in practice. Numerous causes have been identified: shared responsibility, purchase of standard software solutions, time constraints, external commissioning of realization work, intentionally created redundancy as a means of risk management. These and other causes lead to the heterogeneity described above.
Once the core deployment scenarios have been worked out, one often turns to decision making. In the case of deployment scenarios that are multiply supported by different development lines, it will be necessary to either establish the scenarios that are expected to be the leading scenarios or to make decisions for the maintenance of heterogeneity wherever it is unavoidable.

It will also be necessary to consider the costs that arise from redundant development lines: redundant infrastructure for development, testing and production, multiple training expenditures, greater complexity in planning staff deployment. These factors are to be weighed against possible shortfalls in achievable quality, function and punctuality. Finally, it will be necessary to analyze the risks and costs associated with the step-by-step replacement of redundant development lines. In the end, one is in a position to select a development line as a leading line for the deployment scenario under investigation. This is then elevated to the status of a reference architecture model. Alternatively, one can also conclude on the basis of the investigation that heterogeneity is to be accepted either temporarily or for the long run if, for instance, the risks and/or costs rule against a change.

Figure 4-12 below depicts reference architecture models for back office and data warehouse that were derived from the existing development lines of application systems A and D. In contrast, the existing heterogeneity is maintained in the area of mobile sales. The reference architecture model mobile sales can be derived from the current Project F as soon as one has gathered sufficient production experience in this area, experience that represents a prerequisite for defining a reference architecture model. Such cases are also common in practice, for instance, if a very large number of employees has already been assigned to appli-
cation systems E and G, if there is no difference in the operative infrastructure and if only little expense remains associated with these systems in the area of adaptive and corrective maintenance.

Close interaction can be seen here between development planning (see Chapter 6, Planning: Creating Enterprise Architecture) and the derivation of reference architecture. The actual use of reference architecture is documented in development planning. Deployment scenarios represent fields of action in development planning to which reference architecture models can be assigned. The impact of the decision to maintain heterogeneous development lines for a deployment scenario can thus be examined in the context of development planning. Here, we can view, for instance, the deadlines by which current projects are changed over to a defined reference architecture model or existing application systems are replaced. This is illustrated in Figure 4-13 below with reference to Project B and the application system C.
While reference architecture models alone are not a guarantee for the streamlined, homogeneous and efficient development and provision of applications, they are an effective means of achieving this end. Factors such as deadlines and available budget will significantly influence one’s decisions surrounding the introduction and use of reference architecture. As Maier and Rechtin suggest: “The best engineering solutions are not necessarily the best political solutions.” (MRE2002, p. 245).

The procedure outlined enables one to extract reference architecture models and the necessary heuristics from the existing development lines in one’s organization. However, it is not always the case that reference architecture models can be derived from existing development lines. It is sometimes necessary to venture off in a different direction. The standardization of reference architecture should not be allowed to curtail innovation. If a suitable reference architecture model does not emerge in the context of development planning (see Chapter 6, Planning: Creating Enterprise Architecture) for a new system (i.e. no determinations have yet been made concerning a reference architecture model for the deployment scenario), then it will be necessary in the framework of the project or a preliminary examination to arrive at a suitable architecture model by first considering the requirements and
4.3 Software Architecture

conditions that the system is to meet and then developing and evaluating various architecture scenarios. Such cases will involve opening new development lines, making assumptions, backing ones assumptions up with prototypes and initiating pilot projects. If the new development line holds up to scrutiny and meets the established specifications, then what we have is the birth of a new reference architecture model. Only after the successful implementation of at least one system with the new development line will it be possible to derive a reference architecture model from this system for the deployment scenario, a reference architecture model that is appropriately considered in the context of development planning and that comes with empirical data. This is why empirical data are also always available for newborn reference architecture models (e.g. data on quantity structures, performance, availability, reliability, scalability, user numbers, security). Empirical data can also be gathered to a limited extent outside of ones own organization. The sources here include the sharing of experiences with other users, architecture management congresses, congress reports, and published benchmarks. However, the following always applies: there is no such thing as a reference architecture model without heuristics!

The further development of a defined number of reference architecture models is also fed by other sources from which new technological developments and innovation arise:

- An architecture board determines in the context of its examination of project-specific architectural drafts that the reference architecture models are full of gaps and decides to initiate the testing of a new development line that is then taken up into the ranks of the reference architecture models.
- In the context of strategic development planning, one comes to the realization that there are certain fields to which it is not possible to assign a reference architecture model. In order to handle this case, it is also necessary to test a new development line whose elevation to the set of reference architecture models is also initiated.

Both cases presuppose the completion of a department project. Architecture developments that are purely technologically motivated tend to remain unconnected to the enterprise. A solution is presented and a search is conducted for a suitable problem. Let’s leave such undertakings to the manufacturers.
As indicated by these examples, the reference architecture models figure prominently at many locations in the ensemble of our architecture management processes:

- Reference architecture models serve as patterns for operative software architects in the context of project work.
- Reference architecture models serve as a yardstick when architectural drafts are evaluated (e.g. by an architecture board in the course of a project or in the context of a review). Without them, we lack a benchmark for evaluating the suitability of architectural drafts. We wind up holding our discussions in a vacuum. We can only really proceed to evaluate the available architectural drafts after we have arrived at a reference architecture model that has demonstrated its fitness with regard to a defined and documented number of requirements (e.g. structure quantities).
- Reference architecture models are used in the context of development planning to determine the type of structure that is to be built on an undeveloped parcel. The range of reference architecture models can thus be specified in the context of development planning. The requirements (e.g. with respect to the necessary qualifications) can then be derived from these. A further basis is established for human resources development and needs planning.
- The specification of reference architecture models coincides with the determination as to which infrastructure components go into one’s infrastructure standard. The current standard encompasses all of the infrastructure components that are necessary for the implementation of the reference architecture models. This standard will have to be supported both for development and production. Development lines that are to be phased out may require further infrastructure components that are then given production support only until the development lines have indeed been phased out. Further infrastructure components may be supported only with the help of external partners in the area of production.

The description of the valid reference architecture models within the organization’s software architecture includes:

- Determinations for the vertical and horizontal structure in layers and components
4.3 Software Architecture

- Design principles for layers and components
- Guidelines for the use of components and layers
- Definition of principles for the installation of interfaces and communication channels
- Department deployment scenarios
- Heuristics on the deployment of reference architecture models (e.g. quantity structures, infrastructure use, performance, availability, security, scalability, reliability)

It is advisable to establish a standard for reference architecture specifications that indicates (e.g. in the form of a template) what information is to be specified and how this information is to be specified. In addition to written descriptions of deployment scenarios, design principles and empirical data, the use of simple graphical notation has proved helpful. Here, it is less a matter of precision - a formal UML model would probably be more precise - but of easy comprehension for all units that are involved in the development and operation of software systems. Readers may wish to refer to ACT2004\textsuperscript{11} for an example of such a notation.

Like every reference architecture model, every software architecture model possesses platform-independent and platform-specific aspects. Components, modules and layers can be specified without thereby committing oneself to their later technical realization. However, when making the transition to the realization phase, it will be necessary to make the appropriate determinations. For instance, it will be necessary in the case of a software logic component to define how it is to be implemented. Is it to be represented in a COBOL subsystem? Is a C-program to result or will it transform itself, for instance, in a Java Entity Bean that is implemented on a J2EE application server? The Object Management Group refers in its model-driven architecture to platform-independent models (PIMs) and platform-specific models (PSMs).

You will enjoy a number of advantages if your software architecture design matches this pattern:

- The link for the business architecture to the software architecture is considerably streamlined at the level of the PIM.

\textsuperscript{11} See the website for this book: www.unternehmensarchitektur.de
The link between software architecture and system architecture is supported by PSM level.

The representation of PIM elements on PSM elements can be defined via reference architecture rules. These rules of representation govern the transition from the conceptual level to the technical level and take account of the specifics of each reference architecture model when doing so.

The representation rules establish a basis for automation. They support the generation of aspects in the PSM. With the PSM, we then move to the transition into the systems architecture. With its PSM determinations, software architecture strikes the necessary excerpt from the set of standard infrastructure components.

The transition to production is supported in the software architecture by a description of deployment procedures containing information about the following:

- Component implementations
- Directories
- Databases
- Configuration settings and parameters

We thereby also find technical views in the software architecture of the sort that are necessary for applications developers, testers and configuration managers.

Numerous sources of information are available for the creation of a software architecture:

- CASE tools
- Change & configuration management tools
- Dictionary systems
- Testing tools
- Deployment tools

Figure 4-14 below offers an overview of the elements of software architecture (ACT2004). The software architecture's structure is rendered here in the form of a simplified metamodel. The metamodel shown supports several levels of abstraction (Levels A, B,
4.3 Software Architecture

C) in order to take account of both the strategic and operative orientation of the EA.
Figure 4-14: Overview of a Software Architecture Metamodel (Level B)
4.4 Systems Architecture

The systems architecture describes objects in the areas of infrastructure and system operations. The topics that will be addressed in this context include the development and provision of infrastructure components, the operation of applications, service level agreements, and license management.

Lowering IT costs

In the wake of efforts to lower IT costs, the focus often shifts to infrastructure costs. In addition to outsourcing, efforts to lower costs focus on considerations for optimizing the provision of infrastructure services. Popular models (such as ITIL) that aim for service-oriented configurations for the areas of infrastructure and operations are effective here.

IT service management

An inventory of the infrastructure landscape’s current state is a prerequisite for the defining of infrastructure services. This is precisely a point at which architecture management and IT infrastructure service management are complementary. The architecture management creates an EA model that includes the systems architecture as one of its elements. IT service managers find those objects in this systems architecture that they need to define their services.

Including applications development

However, those who attempt to achieve a significant increase in IT efficiency and effectiveness on the basis of IT infrastructure service management alone will soon discover limitations. Doing so will rule out increases in efficiency in the area of applications development relating to the tidying up of development lines. If we wish nonetheless to also improve effectiveness, to optimize the alignment to business concerns, then the business architecture will be indispensable.

It follows that IT service management is a helpful extension and a necessary complement when it comes to improvements in the area of IT services and operations. However, EA is indispensable as a basis for IT service management, architecture management and IT governance.

In particular, the sub-areas of the systems architecture describe the following services:

- Infrastructure management
- Support level definition
- Platform specification
- Network documentation
Not all of the sub-units in the systems architecture are necessarily filled. Some topics are often already covered by established responsibilities and/or tools. It is also important here to make sure that decisions concerning the depth and width of one's EA are aligned to the questions it is supposed to answer.

Resources for handling systems architecture design include:

- Asset management tools
- Change and configuration management tools
- Network management tools
- License management tools
- User help desk tools

**Infrastructure Management**

The objects in this sub-unit of the systems architecture describe the planning and provision of infrastructure components, and thus the structure of the set of infrastructure standards. The set of standards represents all of the types of infrastructure components (structured according to unit) that are available in the organization. A rough breakdown of the set of standards includes the following categories: data management, configuration management, middleware, basic systems (e.g. operating systems and TP monitors), and development and testing tools. Usually only types are described in the set of standards. What is of interest here is not the individual installation of a database system, but merely the fact that a specific type of database system is deployed in the organization and is necessary for the support of the business. Figure 4-15 depicts the structure of the set of standards at the top level.
The application systems are embedded in the set of standards for the systems architecture. These use the services in the development environment, the testing environment and the runtime environment. They use basic systems such as TP monitors and operating systems. They require authorization and authentication services. They are monitored and controlled with the help of administrative tools. They communicate via middleware products (e.g. message queuing), offer user interfaces via suitable services such as workflow control and web interfaces, and use relational data warehouse systems and document management systems.

Figure 4-16 below depicts the embedding of the application systems in this set of infrastructure standards and highlights the structure of the systems architecture. The sub-units of the set of standards contain further sub-structures down as far as the type level that then addresses specific infrastructure components, including a server database system, an applications server and a runtime environment such as the virtual machine of a Java system.
Figure 4-16: Embedded Application Systems

The development environment highlights the structural detail of the set of standards (see Figure 4-17: Structure of Development Environments). The structuring of the systems architecture in this form fulfills the prerequisite for the definition of standards. Many organizations maintain such a standard and use it, for instance, in order to check architectural drafts for projects in terms of their conformity with the standards.

Services in the area of IT operations are defined and service level agreements are worked out on the basis of such a structured set of standards. The set of standards is the basis for license management that focuses on organizational units or at least quantity structures relating to the types in the set of standards.

However, what is most important in the context of EA is the fact that the set of standards structured in this manner is a basis for all kinds of analyses and planning: What infrastructure components are necessary for the development, testing, approval and operation of application systems? What is superfluous? What happens when infrastructure components are replaced and what are the associated costs? Dependency analyses, cost calculations and optimization scenarios presuppose the existence of structured standard infrastructure documentation.

It follows that professionally managed IT operations require this documentation of its set of infrastructure standards for internal purposes: compliance checks, service definition and license management. A professionally managed IT unit needs the set of infrastructure standards as a basis for a comprehensive analysis of the EA and as a basis for the optimization of the EA.
The associated costs to the organization are often cited as a reason against the introduction of such a system. Who can afford the inventory of the current state? Who is in a position to maintain the documentation of the infrastructure standards? Who is to carry the costs? Additional expenses are postulated and the documentation is designated as unaffordable. But while planning does indeed come with a price tag, not planning comes with a bigger one.

Consider how often you have carried out inventories of your infrastructure landscape’s current state in the last few years, i.e. in the context of major projects, restructuring, and acquisitions. Now compare this to the expenses associated with the maintenance of a set of infrastructure standards - not at the level of the organizational unit, but at the level of the type - and the benefits that you have as result of such up-to-date documentation.

Figure 4-17: Structure of Development Environments
Consider the infrastructure management. Consider the set of infrastructure standards as a foundation for EA. Consider the big picture. Do not stop at the planning of the infrastructure landscape alone. Complete a project to install a service management and then stop? Refrain from establishing the reference to the applications environment? Refrain from establishing the reference to the business? Refrain from asking the question as to whether we have the right applications? Precisely this would entail producing major expenses with little benefit.

**Support Level Definition**

No enterprise can really afford to support an ever burgeoning array of heterogeneous infrastructure components. While there are certainly cases in which an additional server database system is purchased (e.g. in connection with the purchase of standard software) although a relevant standard has already been established, this should not take place in an unplanned and uncontrolled manner.

One possible procedure for handling this heterogeneity is to break the set of infrastructure standards down into support levels. If necessary, the support levels can be defined:

- **Level A**: infrastructure components fully support development and production
- **Level B**: full support for production, no support for development, i.e. no development know-how, no development environments
- **Level C**: limited support for production (e.g. via outsourcing of operations) combined with response-time losses, no support for development.

Figure 4-18 depicts three support levels in the set of infrastructure standards for server database systems.
Figure 4-18 Support Level Definition

**Platform Specifications**

Platform management bundles devices or device classes together with infrastructure components to form platforms on which application and/or infrastructure systems can run. Platforms permit one to aggregate the information contained in their various hardware and software components. This information includes attributes such as production costs, operation costs, maintenance costs, purchasing data, depreciation data, availability data, responsibility allocation, and degree of capacity utilization.

New requirements may arise for platforms when new architectural patterns are developed or existing reference architecture models are expanded in the course of projects. System architects use this as a basis for defining platforms. Software architects use platforms in the context of operative architecture management as sequence environments.

**Network Documentation**

Suppose that we intend to initiate an ambitious project involving the development or introduction of a novel application system. In order to do this, we may need new server systems and we will certainly need to recruit additional employees and to support a certain number of users simultaneously. Questions about the current network topology arise repeatedly in this situation, i.e. questions about transmission rates, bandwidths, and backup connections. This information is made available in the context of
network documentation in the EA. The documentation contains descriptions of the enterprise’s network, its components and topology.

Environment Management

Environment management is responsible for managing environments that have been assigned collections of platforms. The relevant environments include a testing and a development environment that have each been assigned specific platforms, for instance, a test server that contains special infrastructure components for debugging and stress tests. Environment management is thus responsible for managing various types of platforms that enable one to develop, test, integrate, approve and operate applications in an effective and orderly manner.

License Management

License management is responsible for administering the licenses available within the organization, including the handling of all related purchasing and checks of the capacity utilization for the existing licenses. The EA gives one the option of storing this information in a general view.

Inventory Management

Inventory management is responsible for handling equipment classes (e.g. printers, storage units, PCs, servers) and instantiations of these classes. Its scope includes describing the configuration of devices, their performance characteristics, the offices that are responsible for their operation and maintenance, and the associated costs. Also referred to as asset management, this unit frequently consists of documentation and maintenance tools. If questions are addressed to your EA that require a detailed investigation at the level of an instantiation, then you should establish a connection between your asset-management tool and your EA. If the level of detail that is required to answer your urgent questions is obsolete, then refer the questions to your IT service unit and move on.

Service Level Management

What is the availability of a platform? What response times are guaranteed in case of breakdown? How quickly does a user
helpdesk respond to error messages. How quickly does one's 2nd-level support respond? Service level agreements define these things. The EA represents a space in which one can make the answers available for all planning processes. But here, too, the following applies: If you already have other means of documenting service levels and if no questions arise that would justify the inclusion of this documentation in the EA, then save yourself this step. The development of EA must conform to the KISS principle (keep it simple and smart!) if it is to avoid the fate of the dinosaurs.

**ITIL and EA**

The documentation of infrastructure services in one's EA creates an excellent foundation for the establishment of a service management, for instance, of the sort described in the IT Infrastructure Library (ITIL). Here we have a case in which EA and service management are complementary. However, I would like again to caution against running only half of the race, i.e. establishing a service management and then neglecting to establish the connection to one's application systems and one's business.

As indicated by recent investigations, while ITIL is aligned to the service orientation of the IT management, “it does not ensure that the application environment will develop in a controlled manner” (HAF04). The research findings referred to here indicate the necessity of establishing an architecture management and EA as a basis for the service orientation associated with ITIL “in order to be able on the whole to plan for, initiate and control the long-term development of the application environment.”

**No isolated approaches**

The integration of architecture and service management on the basis of an integrated general view (as documented and updated in EA) is necessary. Isolated approaches will not offer a basis for comprehensive analysis and planning and thereby forfeit valuable potential.

Figure 4-19 below depicts the abstract metamodel of the system architecture (ACT2004). The metamodel shown here supports several levels of abstraction that are designated as Levels A, B and C in order to account for both the EA’s strategic and operative alignment.
4.5 **Applications Environment**

Most IT units keep a sketch of the applications environment -- that PowerPoint slide with the drawings of all of the application systems, sometimes including their interfaces and assignments to
4.5 Applications Environment

deptments and sometimes combined with top business processes and products in the form of a matrix.

The simplest case involves the assignment of the application systems to departmental domains. Figure 4-20 shows an example in which the application systems are assigned to specific domains (e.g. the Life sector, the Agency sales channel). Other organizations structure their maps according to departmental components. Doing so results in a very similar form of the applications map.

Figure 4-20: Applications Map for an Insurance Company

This illustration gives us an overview. It allows us to sort application systems according to department, sketch interfaces and demarcate fields of action (e.g. for projects). The documentation of the applications environment is thus also possible. But how do things look for analyses? If we want to know how much was invested in the creation of the application systems in one of the domains and what maintenance and support costs are involved, then we will simply not have access to the right information. It

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A study conducted by the Meta Group indicates that the Global2000 possess an average of 59 enterprise applications (PRA2002).
will be necessary to establish attributes, i.e. attributes specifying costs and value contributions, in order to be able to evaluate the applications environment, as well as attributes specifying availability and reliability, age, complexity and deployed technologies.

Figure 4-21 below depicts the realization of such an applications map in an architecture management tool. This case involves an active element that is based on a metamodel, i.e. every application system that is visualized in the applications map possesses attributes (e.g. age, creation costs, operating, availability) and relationships (interfaces) to other elements. This information can be evaluated (e.g. in cost overviews) and compressed (e.g. in key performance indicators). Relationships can be used for dependency and impact analyses so as to answer, for instance, questions such as the following: What application systems and components will be affected when it becomes necessary to replace a computing kernel in the wake of the adjustment of the maximum invoice interest for life insurance policies?

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13 The Metis® tool was used with the EA template for t-eam (ACT2005) to generate this example. For more information, please refer to the website for this book at www.unternehmensarchitektur.de.
If our need for analysis goes beyond this, i.e. when questions are posed that go beyond the evaluation of attributes, then it will be necessary to consider another form of representation. This somewhat other approach to representing an applications map involves the so-called product-process matrix. Here, the application systems are set in relation to the enterprise's top products and processes (Figure 4-21).
This form of representation reveals its suitability in the following analysis of the EA. It enables one to represent and evaluate the application systems with their departmental reference. A matrix of top processes and organizational units is similarly effective. The assignment of the application systems to such a matrix permits one to analyze the departmental coverage with respect to gaps and redundancies and to check interfaces with respect to complexity and heterogeneity.

This development plan enables one to carry out coverage, heterogeneity and cost analyses. The assignment of the application systems to an applications environment of this structure is based on references between the architectural levels business and software architecture. Application systems support business processes and the processing of products. While the visualization in a product-process matrix already supports a number of evaluations, more can be achieved with the documentation of the applications environment in a database and/or a specialized tool for purposes of EA modeling.

A documentation of the applications environment in this form represents an efficient basis for analysis and thereby meets pre-
4.5 Applications Environment

requisites for the optimization of the existing EA. However, the visualization of the applications environment is also a prerequisite for navigation and communication. Such visualization is necessary wherever one turns – in the context of projects, in planning sessions, during consultation, etc. Our experience with projects shows that such visualizations need to be created separately wherever they are not yet available. But such separate creations are seldom connected to a general interest and seldom coupled with the relevant maintenance and updating processes.

Have you assigned attributes to your applications map? Does it permit evaluation? Does it enable you to present information on costs, redundancies, gaps, and breaches? Have you analyzed the number of interfaces? Have you run planning scenarios? Do you really use the data made available by your applications environment? Or are high-gloss copies of it merely hanging on the walls, slowly gathering dust?

Attributes give life to the representation of one’s applications environment. If the objects in the EA bear no attributes, then the documentation of the applications environment will also be silent when it comes to analysis. Costs, strategic impact, dependencies, performance indicators, time and staffing needs, age, capacity utilization – these are the factors that are important to keep track of in the entire EA in order to make sure that it remains subject to evaluation via references in the applications environment.

An applications and infrastructure environment is more than a sketch and more than a map, it is dynamic, it has attributes, it undergoes changes and it can deliver a lot of useful information.

However, achieving this requires planned development. What references do we need? What evaluations do we want to run via these references? How up to date? How frequently? What indicators are to be derived and how should these be compiled? How is the applications environment and infrastructure landscape to be maintained and updated? Who is responsible? Who is involved? Who is to be consulted?

As you see, the establishment of an applications environment and infrastructure landscape generates questions that it is important to answer. After all, the result is the key to the real EA deployment. As mentioned, most organizations have access to an abundance of models. Sadly, one is often not in a position to use these models because they have not been consolidated or har-
monized. They cannot be juxtaposed. They are syntactically and semantically incommensurable.

Establishing an applications environment and thereby answering the questions posed above entails carrying out a syntactical and semantic alignment, synchronizing models and creating references. The resources used to establish this type of applications environment include existing development plans and sketches of ones applications environment.
Analysis: Evaluating Enterprise Architecture

5

Striving to be better,
often we solve what’s well

How much time, money and effort goes into your annual planning – the project portfolio, the prioritizing of projects, the consultations with the departments, the drawing of the red line that cancels the impracticable projects? And all of this with the aim of optimally aligning new developments and adaptive maintenance to the needs of the business. Truly admirable work!

But do you actually spend as much energy, as much effort, and as much care on the analysis of what has already been established, on the identification of weaknesses, on the integration of existing systems, on working out suggestions for new solutions, on technological consulting and the optimization of the current application portfolio?

In the present chapter, I address precisely these questions and attempt to outline procedures for developing a facilities management for IT.

5.1 Overview of Analysis Procedures

Most complicated technical devices require maintenance to ensure the preservation of their functional capacity and their value. Modern vehicles are even outfitted with instruments that tell us when maintenance intervals have elapsed and point out the need to intervene, for instance, when the motor oil is low or the reservoir for windshield fluid is approaching empty.

To be sure, we keep statistics on rates of production and the user helpdesk. But what instruments do we use to observe, analyze and monitor our applications environment and infrastructure landscape? Do you currently have access to up-to-date information on the interfaces and dependencies in your environment? Do you know how often and with what degree of reliability these interfaces are used? Do you analyze redundancies, gaps and breaches in the support that is provided for general com-
pany processes by your applications environment? Are you aware of the flashpoints in your landscape when the question concerning operations, prime, and maintenance costs arises? Do you have access to impact studies that deliver statements about the economic and strategic impact of your application systems?

In the area of IT, we tend to do a lot of planning for the development of new systems: project planning, portfolio planning, utility calculations, gap analyses, SWOT analyses, balanced scorecards, and much more. But there is something especially valuable that we either do not have at all or have only inchoately, something that is referred to in the construction sector as facilities management. Facilities management, encompassing the analysis of weaknesses and the planning of maintenance, optimization and renovation measures from departmental and technical points of view, is often lacking altogether or suffers from the lack of an overall view when the responsibility for it is distributed across the organizational units of applications development. While we usually plan the project portfolio on an annual basis (usually in the context of a general process), we leave the optimization of the existing landscape exposed to the powers that be. The process, which often consumes more than 50% of the entire budget for applications development, is framed by small project budgets, maintenance budgets or line tasks. If this optimization process is nonetheless to reach its target as a part of daily business, if these individual measures are to become a part of the whole, then we will also need an element of general control, a comprehensive architecture management process that not only ensures the transformation of strategy into operative reality for the (smaller) part of the new projects, but also for the (larger) part consisting of continuous maintenance. Here, too, our maxim is: create transparency, derive measures, and exercise governance.

This is precisely where the analysis of enterprise architecture (EA) reveals its utility. So long as they have been joined together in an EA form, the existing models can show their value. This value, this utility that is wrapped up in EA, is often left unexploited. Maps are drawn and application systems are represented, but the models they are based on are not used for purposes of analysis. An opportunity left untaken! Like a collection of maps that is never used, a navigation system that is never deployed.
The value of EA is best exploited when it is used as a navigation system for the IT governance process. Do not be content with the general representations and maps afforded by your applications environment and infrastructure landscape. Make sure that the valuable information in your EA is also actively used for carrying out analyses and for the planning processes based on them.

The notion that one should make the best of what is available before introducing new technology is rather intuitive, especially as maintenance tasks grow in significance compared to new developments. It is naturally not my intention to suggest that one should shy away from innovation, I wish only to call attention to the importance of exploiting existing potential. EA represents the full use of analysis and planning as a part of the IT management process on the basis of a CIO management information system. This is the opposite of commissioning analyses on particular occasions (e.g. the start of the EAI project) that then disappear upon being filed.

What application systems are used by the particular organizational units in your enterprise to support particular business processes? What databases are involved and what interfaces to other application systems are involved? What are the associated quantity structures. In other words, how often are the application systems used and by whom, what data volumes are transmitted and what computational capacities are necessary? What infrastructure systems, including database systems, middleware and TP monitors are required? On what platforms is everything to run? At what availability and at what capacity?

These many questions are well-known and fully legitimate. However, if we manage to answer these questions in a context (e.g. beginning from an organizational unit because you would like to outsource its activities), then we will have reached the operational area of an applications environment. An applications environment establishes the necessary cross references for us. It references beyond the architectural levels and tells us where relationships exist between artifacts in the business architecture and artifacts in the software architecture as well as how these are linked to artifacts in the systems architecture. This is helpful when it comes to the tidying up that has to be done in the wake
of measures to consolidate applications and/or infrastructure components. It is also helpful here to make a finely meshed and complex network of dependencies visible in order to streamline it. At one end of this network, we pull on an infrastructure system (e.g. because we are planning its replacement) and have a look at what else moves: other infrastructure systems that are dependent on the first, application systems that require this infrastructure and organizational units that use the whole complex. The applications environment provides us with an instrument that will help us to carry out such dependency analyses.

This not only supports the analysis of dependencies, it also enables one to ascertain general capacities, degrees of capacity utilization, costs and degrees of availability. Setting the whole thing in relation to objectives, to the prospects of a balanced scorecard allows us to determine the value-creating contribution made by individual components to the achievement of the organization’s goals. This enables us to do more than carry out systematic analyses, it enables us to then go forward and evaluate and to orient our actions accordingly. In short, it enables us to achieve genuine IT governance.

The following table offers us an overview of the procedures for analyzing the EA and the questions that these procedures allow us to answer:

<table>
<thead>
<tr>
<th>Object under Investigation</th>
<th>Description of Procedure</th>
<th>Typical Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependency</td>
<td>Directly or indirectly (i.e. cross-level) linked elements in the EA are selected. Relationships and their impact are shown.</td>
<td>What other elements are affected when we replace infrastructure component X?</td>
</tr>
</tbody>
</table>
### 5.1 Overview of Analysis Procedures

<table>
<thead>
<tr>
<th>Object under Investigation</th>
<th>Description of Procedure</th>
<th>Typical Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coverage</td>
<td>The coverage of departments (e.g. units in a process-product matrix) by application systems is analyzed.</td>
<td>What redundancies or gaps exist in the IT support for process X and/or product Y and/or organizational unit Z?</td>
</tr>
<tr>
<td>Interfaces</td>
<td>The interfaces between the application systems are analyzed in terms of their type, number, complexity, frequency/currency, performance, stability, and availability</td>
<td>Does the support for process X contain gaps and cases of heterogeneity? Are common steps in product processing also handled in a cross-product manner?</td>
</tr>
<tr>
<td>Heterogeneity</td>
<td>The heterogeneity of ones IT assets in defined areas of deployment is analyzed.</td>
<td>How many development lines (technologies) are there per deployment area (e.g. a unit in the process-product matrix)? How many infrastructure components are there per cell in the set of infrastructure standards?</td>
</tr>
<tr>
<td>Complexity</td>
<td>An analysis is run to determine how many components there are in the EA and how many relationships they have.</td>
<td>How many application systems exist? How many interfaces do they have? How many infrastructure components and platforms exist? How many interfaces exist among them or to the applications environment?</td>
</tr>
</tbody>
</table>
## 5 Analysis: Evaluating Enterprise Architecture

<table>
<thead>
<tr>
<th>Object under Investigation</th>
<th>Description of Procedure</th>
<th>Typical Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conformity</td>
<td>Adherence to standards and ascertainment of the degree of variance (e.g. as a % of the application systems or infrastructure components)</td>
<td>Has adherence to existing standards (e.g. the set of infrastructure standards) been secured? Have the defined reference architecture models been implemented? What percentage of all components is out of compliance with the standards?</td>
</tr>
<tr>
<td></td>
<td>Compliance rules</td>
<td>Has compliance with legal provisions, market standards and norms (e.g. Sarbanes-Oxley and Solvency II) been secured?</td>
</tr>
<tr>
<td>Costs</td>
<td>Reporting on accumulated production, operation and maintenance costs</td>
<td>What costs are associated at all levels of the EA with the IT support of product X?</td>
</tr>
<tr>
<td>Benefits</td>
<td>Benefits calculation, e.g. as percentage contributions to the achievement of enterprise goals or via defined key performance indicators (KPIs)</td>
<td>What contribution to the support of enterprise goals is made by application system X?</td>
</tr>
</tbody>
</table>

In what follows, I would like to consider a number of particular analytic procedures. Here, it is important to bear in mind that each of these procedures is equally applicable to the top view of the EA, excerpts, detailed views, and variants of temporal (e.g. expansion phases) and substantive types (e.g. development alternatives such as custom developments and standard software). This enables us to analyze iteratively from the top down or the bottom up, and then plan. The step-by-step focusing on views (e.g. in which weaknesses were identified) is also supported.
5.2 Analysis of Dependencies

The analysis of dependencies, also commonly referred to as neighborhood analysis, can be made in the form of a report or graphically visualized. Figure 5-1 depicts a segment of an architecture management tool that shows the relationships between an infrastructure component, the applications systems based on it and the supported business processes.

Figure 5-1: Dependency Analysis (ACT2005)
5.3 Coverage Analysis

The coverage analysis presupposes a structuring of the applications environment according to department. Figure 5-2 depicts a product-process matrix that gives us a lot of useful information about redundant IT support.

A number of the matrix cells in this example are double-occupied, including PoS systems for mobile and stationary sales and several policy administration systems for various Life and Composite products. The enterprise architect faces the task during the next EA planning phase of determining whether and how this situation can be corrected. The starting point will involve a deeper analysis of the flashpoints shown. Does the multiple support of PoS Life by various systems have a negative impact with respect to time-to-market in the case of the introduction of new life insurance products or with respect to the costs for the IT support? Are there departmental reasons for retaining the redundancy? Would it be possible to bundle PoS systems for various sales channels? What would be the associated costs? What would be the benefits? Various hypothetical scenarios are to be devel-
5.4 Analysis of the Interfaces

Operated and evaluated in the context of further enterprise architecture planning.

As shown in Figure 5-3, the use of such a matrix also makes it easy to identify gaps in the IT support:

![Image of a matrix showing coverage analysis of gaps]

Figure 5-3: Coverage Analysis of Gaps

Detailed investigations are also necessary to assess the gaps found during the present analysis:

- Reasons for gaps and redundancies
- Impact of the white spaces on business and IT
- Risks associated with gaps and redundancies
- Costs of eliminating the white spaces and redundancies.

5.4 Analysis of the Interfaces

The analysis of the interfaces first involves a consideration of the number of interfaces between the application systems. The maximum number of interfaces N in an applications environment with n systems can be derived using the following formula:

\[ N = \frac{n(n-1)}{2} \]
(which also figures in our discussion of the subject of enterprise application integration):

\[ N = \frac{n(n-1)}{2} \]

While the other discussion centers on simple technical solutions to this interface problem (e.g. a reduction in the costs via a common interface format in a so-called hub-and-spoke architecture), what interests us in the context of EA analysis is primarily the issue of identifying the causes. Where would a different arrangement of application systems allow us to jettison interfaces? Where might we combine systems? What systems might we classify as obsolete (see Figure 5-4)?

![Figure 5-4: Interface Analysis](image-url)

Of equal importance in our interface analysis is the type of interfaces deployed. Here, too, the focus is more directed to an identification of the causes than to a technical cure of the symptoms. The requirements that are to be met by interfaces can be derived from the arrangement of application systems and ultimately from the support that is thereby realized for the business. How often
5.5 Analysis of Heterogeneity

is it necessary to service interfaces? What updating requirements apply? What stability requirements apply? What change requirements apply? What availability requirements apply? If these requirements are excessive and if there is at the same time a large number of interfaces, then the EAI problem is serious and will have to be treated at the roots.

5.5 Analysis of Heterogeneity

Heterogeneity (i.e. suspected heterogeneity) is often addressed when measures are initially being implemented in the area of EA or service management. One often begins where heterogeneity is most conspicuous: in the area of infrastructure. It quickly becomes clear that there is often more than one approach to the same task in the organization: How many types of database management systems are necessary? How many different middleware components? How many business process management or case tools. How many programming and development environments?

The use of a simple classification system, the drafting of a set of infrastructure standards, allows us to ascertain very quickly in the infrastructure area that we have extra freight on board (unnecessary components) that is slowing down our journey. The solution is obvious: We set up a project for infrastructure consolidation. And while we’re at it, we turn the project into a service management.

This reminds me again and again of the following little story I quoted in Chapter 2.7:

On a dark night, a man was on his hands and knees under a lamp-post searching inch by inch for a lost object. A policeman came along and asked what he was doing. “Looking for my house keys,” was the answer. “And where did you drop them?” “Over there by the bushes,” was the answer. “Then why are you looking here?” “Because the light is better.”

A wonderful example of efficient work at the wrong construction site. Just as with most homogenization projects in the area of IT infrastructure: a case of working on the symptoms and not on the causes. Why then do we have such a high degree of heterogeneity in the area of infrastructure? Because we have grown accustomed to meeting business requirements with other means. Heterogeneity in ones infrastructure is a consequence of hetero-
geneity in one's application development procedures - in short, development lines that are, in turn, a consequence of an inadequate requirements management. Here, I do not mean to refer to the burgeoning documentation of requirements, but the professional management of these technical specifications: classification, representation of unit-based deployment scenarios, and assignment of reference architecture models. It will be necessary to first homogenize the applications portfolio and bring about a stable convergence of the various development lines. How can we bring about a sustainable reduction in heterogeneity if we do not get at the roots of the problem? This presupposes the intelligent use of available solutions, the identification of requirements of the same kind, and the joining of requirements from different sources. Put succinctly: the linking of requirements with the instruments that will provide a solution, the establishment via EA of the interconnections.

If we are sincere in our efforts to analyze heterogeneity and if we really want to identify and exploit potential for increasing efficiency, then we will have to begin with the business, with the requirements and with the applications portfolio. This should not be construed as a criticism of service and infrastructure management. I wish only to make the point that one should address them only after one has done one's homework at the applications portfolio construction site.

How then shall we begin? The matrix described in the previous chapter offers an effective means of establishing a connection to the business. This matrix accommodates core business processes and main products, alternative organizational units, locations, and production facilities. It forms the technical framework for the analysis. The cells of the matrix contain the application systems that support a business process for the processing of a product. If we work with organizational units instead of products, the matrix shows us what business processes in the organization are supported by specific application systems.

If we now break the analysis down a little further and have a look at the development lines that were deployed to realize the application systems, then the cells of the matrix will be populated with the development lines that were deployed to support processes and products (see Figure 5-5). A large number of development lines per cell initially yields only one indicator for heterogeneity. The same approach should be taken to the values
5.5 Analysis of Heterogeneity

on the distribution (number of cells per development line) and the absolute number of systems.

Multiple development lines per cell in a product-process matrix give the enterprise architect a reason to conduct further investigations:

• Are multiple organizational units being used here to support various development lines?

• Is this accounted for by organizational differences (e.g. different sales channels)?

• Or is it a matter of unchecked growth that is accounted for by history, various IT development units, and the partial deployment of standard software?

• Is the vanity of individual organizational units at work here, i.e. units that simply have to have their own IT system?

Similar questions arise when we deploy our matrix not with respect to products, but with respect to the organizational units.

While it will not always turn out that entire columns in our matrix are homogeneously supported by unified reference architecture models (differences in products will tend to defy this), the abiding question for the enterprise architect must be whether potential for greater unification exists – whether this is a matter of the replacement and bundling of application systems or lobby work on the business side in order to exploit potential for lowering costs. As already outlined, every additional development line is additional freight that slows us down on our journey and uses up our precious resources.
The procedure outlined so far enables us to identify potential areas of homogenization in the applications portfolio. This potential is a basis for the development of planning scenarios (see Chapter 6.3).

The classification of all infrastructure systems will facilitate the analysis of heterogeneity in the area of infrastructure. The structure of the set of infrastructure standards (see Chapter 4.4) will help us to identify overpopulation. Figure 5-6 offers us a view of a set of infrastructure standards structured in this manner (i.e. as represented in the Metis® architecture management tool).

Heterogeneity can be easily identified in this illustration by the populations in the individual cells. If infrastructure functions (services) are rendered by multiple infrastructure components, then this, too, gives the enterprise architect a reason for considering optimization. For instance, if multiple relational database systems appear in the set of infrastructure standards, then it will be necessary to determine via dependency analyses what application systems use these database systems. Every optimization measure must be planned iteratively and the impact on the overall EA must be taken into consideration.
Figure 5-6: Set of Infrastructure Standards (ACT2005)
5.6 Analysis of Complexity

In 1991, Capers Jones published a list of 20 types of complexity for software systems, including structural complexity, logical complexity and topological complexity. In his publication, Jones suggests that only a few types of complexity are really subject to objective analysis (JON1991). In practice, little has changed since then in this regard.

While individual metrics for measuring software system complexity have been made available (e.g. the McCabe Metric), we continue to lack the necessary instruments for measuring the complexity of entire applications environments. It is generally the case that the complexity of applications environment $C_{al}$ can be derived as a function of the number of application systems $A_{as}$ and the number of interfaces $A_{if}$:

$$C_{al} = f(A_{as}, A_{if})$$

The McCabe Metric has proven reliable when it comes to measuring the inner complexity of software systems, and it delivers a good first approximation. However, given that no benchmarks or branch-specific indices have as yet been made available, an analysis of the complexity of one's applications environment that has been derived on the basis of simple metrics can at best serve as an indicator for progress made by the architecture management in one's own organization.

With the increasing significance of EA management as a means of establishing an informed IT governance, standards can also be expected to arise in the area of analysis procedures (particularly for measuring the complexity of applications environments) that include the necessary benchmarks. The use of model-based EA (furnished with measurable attributes) that can be adjustably represented in a tool enables one to create the basis for such further evaluations.

14 The McCabe Metric calculates the complexity $C$ of a system from the number of nodes and edges. (MCC1976)
5.7 Analysis of Conformity

In light of the recent introduction of various legal codes, the conformity of one's EA to various guidelines has emerged as an important issue for many organizations. Whether it is a matter of the provisions on equity capital and its documentation and control contained in Basel II, the provisions for internal systems of corporate control contained in the Sarbanes-Oxley Act, Section 404 (SAR2002), or the Compliance Rules of the Sharma Risk Map in Solvency II (ZBR2004), what is involved are rules that also have great significance for IT.

Examinations of compliance with legal requirements usually consist of ascertaining the existence of the various items required: Has provision been made for the documentation of defined EA elements (e.g. business processes)? Have descriptions of relevant procedures been drafted (e.g. deployment procedures and environment management procedures that secure a compliant production startup of application systems)? Has provision been made for reliable procedures for recovery, backup, authorization, authentication, etc.? Has the organization established a security policy?

These few of the many examples that one could cite in this context clearly indicate that it will be necessary to make provision in one's EA for the running of any manner of compliance checks. This is of considerable significance for the technical representation of your EA. While tools that possess the capacity to execute fixed compliance examinations (e.g. with respect to Solvency II) may appear helpful at first glance because they promise a quick start and a precise targeting of the current task, the relevant codes tend to change quickly and continuously and one is soon in the unenviable position of having to use an obsolete tool to check for compliance with new rules.

Recall the golden rule on tools for the EA management and tools for compliance checks: they must be capable of delivering rapid responses to today's pressing issues, while also possessing the necessary degree of flexibility to handle future tasks.

In addition to the compliance rules of a binding legal nature and that have a significant impact on both business and IT, EA offers many-layered compliance checks that are a part of IT governance and that represent a prerequisite for the efficient transformation of strategic plans into operative reality. These compliance checks address core EA elements. Do all productive application

Compliance rules

Compliance checks
systems comply with the defined reference architecture models? Are all of the development procedures and tools that are in use defined in the set of infrastructure standards? Is at least one convergence of the deployed development lines to the reference architecture models detectable? Have all of the deployed infrastructure components and platforms been internally certified?

As we have seen in the previous chapters (and had to endure often enough in reality), the lack of compliance in these areas, a result of a history of pragmatic and tactical solutions, is a formidable hindrance to IT efficiency. How is one to respond quickly to the requirements of corporate units, develop agile processes and help shorten time-to-market performance when one has to contend with a ball and chain comprised of heterogeneous development technologies, incompatible processes and tools, and a staff that is not universally qualified?

Have you ever sought to establish an overview of the development technologies that are deployed in your organization? The heterogeneity analysis outlined in Chapter 5.5 offers us an initial overview. The example shown in Figure 5-5, as illustrated on the basis of our product-process application system matrix (see Figure 4-22, p. 120), shows the various development technologies that are deployed to support products and processes. The development technologies detected in the course of the analysis outlined in the example offer the enterprise architect a rough guideline for homogenization. A means of homogenization presents itself in the definition of reference architecture models (see Chapter 4.3 Software Architecture) and their implementation in projects via the checking of architectural drafts by an architecture board and the work of solution architects in the context of operative architecture management (i.e. the work of department, software and system architects in the line and in projects).

Using the heterogeneity analysis as a foundation, the compliance analysis will involve an investigation of the areas in which differences to the previously defined reference architecture models appear. This is shown in Figure 5-7:
5.7 Analysis of Conformity

Investigations of applications environment conformity with reference architecture models or conformity with the set of infrastructure standards play an important role when it comes to the implementation of strategic EA specifications. These investigations enable one to identify variances, deficits and specific areas in which it is necessary to take action. The continuous analysis of the EA is among the core responsibilities of the architect and provides a basis for the development of scenarios for the elimination of weaknesses (see Chapter 6: Planning: Creating Enterprise Architecture).

The list of potential measures is long: renovation, replacement, migration, integration, and outsourcing. This is why the practice of devising scenarios, whose development generates a wealth of ideas, has proven so reliable. This is then followed by the evaluation of the scenarios, the selection of the most promising scenarios, the implementation of measures based on the most promising scenarios and, as appropriate, review and correction followed by new compliance checks. During the implementation phase, it is important to ensure the effective linking of strategic architecture management to operative implementation. The solu-

Figure 5-7: Compliance with the Defined Reference Architecture Models
tion architects involved in projects qualify as direct consultants to the enterprise architects who draft implementation plans on the basis of their analyses and incorporate project feedback into their planning. It is also necessary to align the processes of strategic architecture management with those of operative architecture management. The architecture board, which is mainly responsible for reviewing project drafts in terms of their architectural compliance, makes a further contribution (see Chapter 8.2: Boards).

5.8 Analysis of the Costs

IT cost statements are available in any organization in some form or another. As soon as the establishment of EA is up for consideration, it is often easy to refer to these statements and to dismiss a more thoroughgoing assessment of the costs associated with the EA. But this would be too fast. Experience with EA has shown us that an interest in a more detailed assessment of the costs often arises from the analyses enabled by the architecture, for instance, in order to be able to juxtapose the costs associated with heterogeneity, redundancy and complexity. This presupposes a breakdown of the costs that is suitable for the individual EA structures.

Cost model

This involves a consideration of production, operation and maintenance costs for application systems, infrastructure components and hardware. Figure 5-8 below shows a detailed cost model for a software system (application or infrastructure system).
5.8 Analysis of the Costs

The model includes a consideration of initial purchase costs, maintenance costs and operating costs, including a breakdown of the human resources and material costs for each item. The initial investment is broken down according to annual depreciation (AD). The maintenance and operating costs are also shown in annual amounts. The annual costs for an application system can be derived accordingly from the following equation (Figure 5-9):

\[ K_{ASi} = \frac{(I_{sk_{ASi}} + I_{pk_{ASi}})}{AD} + W_{pk_{ASi}} + W_{sk_{ASi}} + B_{sk_{ASi}} + B_{pk_{ASi}} \]

Figure 5-9: Annual Costs per Application System

This cost model enables us to represent (e.g. in the product-process application system matrix) cost distributions. Figure 5-10 below offers a representation of the initial purchasing costs broken down into three cost classes.
Further cost analyses help us to determine the accumulated costs (e.g. for the support of a sub-process or for an organizational unit) by summing the deployed systems with the use of a percentage degree of support. This comprehensive analysis presupposes a linking of the levels in the architecture, as is given by EA.

5.9 Analysis of the Benefits

What are the benefits of an application system or a platform? What value do these things have for the organization? These are the questions that are posed again and again. The answers are many:

- Economic: the sum of investments
- Pragmatic: as assessed by users and/or managers
- Methodological: impact on the organization’s goals
- Organizational: degree of support for business processes
5.9 Analysis of the Benefits

- Risk-oriented: assessment of the maximum loss associated with breakdown

While this list makes no claim to being complete, it does give cause to consider the option of going ahead with the analysis. Those organizations that refrain from undertaking an evaluation of the benefits forfeit an important dimension of the overall analysis. All of the results from the analyses outlined so far are in need of evaluation. The gaps, heterogeneity, dependency and complexity are not critical per se. Only when such weaknesses are detected in enterprise-critical areas does it become a matter of urgency to get to work on their elimination.

Enterprise-critical factors can be identified on the basis of the following supported areas:

- Processes
- Organizational units
- Products (percentage of overall sales)
- Sales channels
- Business divisions

It is therefore important to identify and operationalize processes that have a considerable impact on the success of the organization’s mission and products whose share of overall sales is currently high or that exhibit strategically planned growth. This will enable one to derive (e.g. in our often cited matrix of business processes and products) the critical areas in which products that are successful and that are expected to be successful and processes that have considerable significance for enterprise goals are supported. Figure 5-11 below depicts this derivation.

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15 This matrix can also be constructed to account for business processes, organizational units, locations, and business divisions.
The evaluation of the benefits (e.g. with regard to sales share and process significance) helps us to identify critical areas for further development planning. If weaknesses with respect to dependency, coverage, interfaces, heterogeneity, complexity, compliance or costs are identified in the context of the previous analyses, then those who are responsible for development planning will need to address these weaknesses in the order of their priority (as derived by reference to the areas that qualify as critical).

How are we to evaluate the factors that determine critical areas? The figures for current and forecasted sales shares are available in business reports and plans. The evaluation of process significance is somewhat more difficult. We can already imagine ourselves sitting in a workshop for executive managers and contemplating the relative significance of various processes for the overall success of the enterprise. A promising undertaking? At first glance, this appears as little helpful as an attempt to directly measure the value of IT products (such as application systems).
5.9 Analysis of the Benefits

for the enterprise. What we need is a catalyst to initiate and accelerate the evaluation process.

Figure 5-12 below shows such a catalyst in the form of a model that was developed by the European Foundation for Quality Management (EFQM) to depict an organization’s main success factors.

This model offers a description of 9 main success factors that are subsumed under one of two categories, “enablers” or “results”. The EFQM also offers a sample prioritization of the 9 factors based on their relative contribution to an organization’s overall success. The percentages shown are to be adapted to specific organizations.

If one regards the optimization of these main factors as the organization’s highest objective, then one will be able to derive the significance of business processes from their impact on the op-

16 Experience shows that evaluations of the importance of IT products by users and product managers lack a sufficient degree of objectivity. Such evaluations are tied to operative work and tend to conclude that everything is important.

17 See http://www.efqm.org/.
5 Analysis: Evaluating Enterprise Architecture

timization of the success factors. Figure 5-13 below depicts a derivation of this kind. In particular, it shows how the significance of a core process is derived from the sum of all support services for the main success factors.

Figure 5-13: Derivation of Process Significance

As a neutral model that adds a sufficient degree of objectivity to the investigations in question, the EFQM model has proven to be a reliable catalyst for the evaluation of process significance. Other models that resemble the EFQM model in important respects have also proven to be suitable. Once one has derived the relevant process significance, it is important to ascertain the degree of support offered by application systems for specific business processes. Sources here include data on the organizational affiliation of the users and detailed business process models that specify the application systems that support process steps. Figure 5-14 below depicts the derivation of the target support that is rendered by an application system for the enterprise’s main success factors (as per EFQM).
5.9 Analysis of the Benefits

The target support of application system $Z$ is derived from the sum of all products of process significance for the supported business processes $P$ and the corresponding degree of support $SP$.

$$Z_{AS_i} = \sum P_{AS_i} \times UP_{AS_i}$$

The economic utility drawn from the share of sales from the supported products is derived in a similar manner to that of the target support rendered by the application systems. Figure 5-15 below depicts this derivation.
5 Analysis: Evaluating Enterprise Architecture

The value $V_{AS_i}$ created by an application system is derived from the sum of all products of the sales share of the supported products $T$ and the corresponding degree of support $ST$.\(^\text{18}\)

$$V_{AS_i} = \sum T_{AS_i} \times UT_{AS_i}$$

The derivation of target support and value creation provides a foundation for the analysis of the applications environment in the magic quadrant. The application systems appear in this portfolio along the coordinates of target support and value creation, with the size of the balls giving us information on the annual costs associated with the application systems. As shown in Figure 5-16 below, a need for action is identified wherever minimal target support, minimal value creation and high costs converge.

\(^\text{18}\) The reference here is to a percentaged share of the overall value created by IT products and not an absolute value created that largely results from work in the organization's units.
The procedure that is illustrated here in very simplified form is only one example out of an extensive collection of methods for operationalizing the utility potential of your application systems. It is not my intention here to evaluate preferences for this procedure, which is based on an operationalization of enterprise goals, procedures based on a balanced scorecard approach, calculations of the respective contributions to value creation or entirely different procedures. The best procedure is precisely that procedure that works best in your organization, i.e. the procedure that is accepted by your top management. It would not be helpful at this juncture to carry out a debate about the right method because it is no longer a matter of applying the right method, but of achieving the right result.

However, it warrants pointing out at this juncture that the many possible methods and the senselessness of a corresponding debate do not mean that you may refrain from taking this step and that this analysis is unimportant. On the contrary, this analysis enables you to connect your EA to your business strategy and to make sure that increases in both efficiency and effectivity remain on the agenda! The analysis will enable you to wield the right instruments when approaching EA maintenance tasks. While you
will be able to effectively combat development line heterogeneity, thin out an infrastructure marked by unchecked growth, achieve savings in the area of license management and increase capacity utilization and otherwise secure efficiency without a connection to business aims, you will not be able to ascertain what exactly will have to be addressed to achieve the greatest utility. You will not be able to score the quick wins, harvest the low hanging fruits and chart the course. You thin out the jungle, but you do not know which direction will take you along the shortest path to the goal. This is precisely why this analysis step is indispensable for all enterprise architects who are not content to merely lubricate the gears, but also see themselves as responsible for navigation.

The enterprise architect's mission is certainly not an easy one. It often creates resistance when the goals are supposed to be made operational. But this introduces an important binding aspect to EA planning and development. This is why the following factors are high up on the enterprise architects agenda: a binding definition of the goal, a view of the big picture, transparency and navigational assistance, securing of smooth progress, in short: support for the IT governance process. Isn’t it nice, when things just work?
Planning: Creating Enterprise Architecture

**Architecture takes place between two ears.**

Most organizations have a map of their applications environment and infrastructure systems. How up to date and accurate is your map? Is it also used for purposes of planning, i.e. does it include representations of multiple past and future states? Are you able to run gap analyses of current and target states? Do you have a practice of aligning your project portfolio with the measures derived from the planning of the applications environment and the gap analysis? Does this or some other procedure allow you to ensure that the various measures of technical renovation (e.g. enterprise application integration) harmonize with the IT investment strategies of the departments in your organization and that are outlined in the project portfolio?

6.1 IT Development Planning

Development planning may have a technical and/or business orientation, i.e. it may concern the infrastructure landscape and/or the applications environment. In either case, development planning represents a necessary extension of traditional portfolio management whenever its goal is not only to optimally satisfy the requirements of your clients, but also to plow ones own field, i.e. to establish the future security and stability of the current applications portfolio.

**Development planning**

Development planning integrates the planning of new projects with the optimization of existing systems, the securing of stability and integration, the closing of gaps, the elimination of redundancies and breaches. The outstanding significance of development planning arises from the elimination of unnecessary heterogeneity and the standardization of infrastructure and application systems. The fact that heterogeneous infrastructure landscapes possess a high degree of complexity and thereby generate high costs has long since been recognized. The heterogeneity of applications environments always comes up for consideration when it comes to eliminating clearly redundant applications in the context of mergers and acquisitions. But have you ever taken
a look at your applications environment independently of such external factors and asked yourself whether it really has to be so complicated?

Let's consider an example from the insurance industry: The classic back office systems for inventory management are being developed on a mainframe in COBOL, the sales systems for mobile sales in C++, and the systems for stationary sales via sales partners in Smalltalk. What is more, the premium calculators on the Internet have an HTML format, while the C++ computing kernels are linked via Java Servlets. The new website has been realized by an external supplier in .NET technology and responsibility for its maintenance is currently being transferred to internal employees. The new generation of inventory management is to be developed in J2EE technology, which is currently being implemented in a pilot project known as PartnerSystem.

Our scenario involves no less than six different technologies that are not a matter of programming languages, but of complete development lines, each with its own programming conventions, tools for version maintenance, testing, debugging, and perhaps even for applications analysis. Each line requires support, each requires specialists and each a human resources development program. And all of the lines will have to be technically integrated with one another.

Does this come across to you as an exaggeration or a description of other people's problems? If yes, then skip ahead to the discussion of the significance of development planning in the context of restructuring projects and standard software development. Those of you, however, who can relate to my sketch of an imaginary, but nonetheless realistic applications environment in the insurance sector may wish to stay tuned.

The point here is not to condemn or try to prevent the introduction of new technologies, but to highlight the importance of planned development! Which development lines are necessary? Which have arisen in connection with a strategic plan? Which qualify as technological mistakes or excess baggage and should be jettisoned? Which have arisen because projects were outsourced without explicit architectural specifications on account of staffing shortages? For which of these development lines would it also make sense to outsource the maintenance and continued development (perhaps temporarily)? And which have
6.1 IT Development Planning

arisen because one simply wanted to satisfy ones technological curiosity or follow ones penchant for trying things out?\(^{19}\)

Current-state inventories taken in the context of development planning enable one to reveal such sins, and once revealed, they can be combated with a restructuring of development lines, additional deployment scenarios and the creation of reference architecture models. I will consider such measures of operative architecture management more closely in Chapter 7.3.

Are you convinced that development planning is only something for organizations that rely extensively on the development of individual software? As the name indicates, the user of standard software manages the standardization process by purchasing it. But how do you manage changes? How do you plan the integration of a standard software package into your mature landscape? How do you secure peaceful coexistence in the transition phase that allows you to avoid a big-bang approach the software’s introduction? How is the migration to be handled? These are the standard questions relating to the subject of standard software that are answered in the context of development planning in light of the release dates specified in your standard software project. What is more, the same applies to all projects whose results entail far-reaching changes to ones entire applications environment.

The process of developing a development planning program defines the procedure for operational and technical development planning. The main tasks in this area include current-state assessments, linking of development planning to strategic goals, the development and evaluation of scenarios, the control of development, and the management of the project and applications portfolio.

Development planning in this context refers to the operationally driven procedures for developing the target structure of an applications environment. The applications environment encompasses the areas of business, applications and system architecture. It thereby permits, for instance, the following referencing sequence: business process -> application system -> infrastructure.

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\(^{19}\) You should count yourself as fortunate if you, too, have such characters in your IT unit!
Development planning thus involves the drafting of a target state of the applications landscape, i.e. a big picture of all application systems including the assignment of the items listed below as well as attributes such as utility, age and quantity structures.

- The supported business processes/sub-processes
- The implemented business components
- The software components
- The deployed infrastructure components
- The organizational units (owners, users, service providers)

No distinction is being drawn here between business and technical development plans because the procedures for the two are the same (i.e. it is also necessary to connect the technical development plan to ones business aims in order to be able to evaluate priorities). If reference is made here to strategic applications planning as a result of development planning, then such plans will include both applications and infrastructure. If necessary, the procedure’s application can be reduced to a single view in order to create a technical development plan.

The development plan is developed in the context of the enterprise architecture (EA) cycle:

- **Document!**
  - Determination of the EA’s current state (Document!)
    - Define model.
    - Implement model.
    - Populate model.

- **Analyze!**
  - Analysis of the EA’s weaknesses (Analyze!)
    - Analyze model.
    - Visualize model.

- **Plan!**
  - Drafting of a development plan (Plan!)
    - Develop scenarios that represent possible target states for the applications environment.
    - Evaluate scenarios in terms of their impact on enterprise and IT goals, costs and risks.
    - Analyze gaps.
6.2 Administering Enterprise Architecture

- Develop development plan – the best route from a current-state applications environment to a target state.
- Implementation of the plan (Act!)
  - Develop reference architecture models.
  - Implement architectural drafts.
- Control (Check!)
  - Define key performance indicators (KPIs).
  - Evaluate KPIs.
  - Check architectural drafts.

The procedures for determining the current state, establishing a practice of continuous documentation and analyzing the EA were described in the previous chapters. For now, I would like to concentrate on the subject of planning before moving on in the following chapters to the subjects of implementation and control.

6.2 Administering Enterprise Architecture

As I have indicated, EA reveals its real value only after one goes beyond the pure documentation of current states. Before getting ahead of ourselves, however, it is important to outline the conditions that will have to be met by your EA so as to enable you to analyze weaknesses, develop future scenarios and derive plans:

- We need to make sure that our assessment of the contents of our current EA (as-is model) is indeed up to date.
- We have to be able to derive and develop scenarios from the current state of our EA (also referred to as what-if analyses). The documentation medium for our EA will thus have to support a versioning procedure, with several versions being compiled in a common model in order to share common elements and carry out comparative analyses.
- It must be possible to develop the favored scenario into a target state (to-be model). It will therefore be necessary to make sure that we are in a position to compare and administer (via the use of common elements) several models with disparate periods of validity. The documentation medium should support the corresponding historicizing process.
EA is based on the current state of business processes, organizational structure, application systems and infrastructure. How up to date is the EA model? It is always as up to date as its weakest link. A service level agreement for your EA can assure an up-to-date status that is derived from the possible update cycles that apply to the artifacts documented in the EA. The updating procedures that you use (e.g. manual updating or the electronic transmission of data from other systems) will have an impact on the degree to which your EA is up to date.

As a rule, the necessity of an automated updating procedure will increase along with increases in the level of detail exhibited by the models in your EA and the number of details you would like to evaluate. A lot of old information tends to be useless. This is another reason why the initial decision on which information and artifacts are to be fed into ones EA is of great significance.

If you would like to keep representations of historical states and retain the capacity to run analyses of the past as a way of learning more, then you will need the capacity to historicize in connection with your EA. You will certainly also use the EA as an instrument of planning by maintaining various scenarios of a conceivable future and representations of straight future states. The documentation medium you use to administer your EA will also have to support the representation, storage and evaluation of past and future states (see Figure 6-1).
6.3 Developing Planning Scenarios

The diagram indicates that in addition to administering the validity periods, it will also be necessary to represent multiple parallel (i.e. simultaneous) versions. These define planning states for your EA that may involve disparate representation depending on events or decisions projected to occur or be made in the future. The alternative scenarios in the diagram include development based on the introduction of a custom software package, development based on the introduction of application service providing and development based on the introduction of a standard software package.

In addition to the administration of historical, future and alternative states, it will also be necessary to create views and projections. The executive board would like to see a top view of the organization’s goals and their support via business processes and application systems. The divisional manager of infrastructure and production would like to have a map of system operations. A project manager at work on the introduction of a standard software package requires a view of the software architecture that shows all of the relevant existing and prospective interfaces. All of this information is available in the EA. It only needs to be extracted and prepared - no trivial task for the administration tool.

As you can see, the present issues are closely tied to considerations having to do with the right tools. The tools that can be used to administer EA include custom-developed architecture dictionaries based on ones own metamodel or standard commercially available tools. In any case, you will need the following:

- The ability to store past and future states
- The ability to administer various versions identical periods of validity
- The ability to form views and projections for specific stakeholders.

6.3 Developing Planning Scenarios

The various reasons for initiating the development of planning scenarios include the following:

- Weaknesses have been detected in the context of the continuous EA analysis (e.g. the inadequate integration of application systems that support common business processes).
The elimination of these weaknesses is to be incorporated into development planning.

- In connection with the setting up of a major project that will change large portions of the applications environment and/or infrastructure landscape, it has become necessary to develop solution scenarios for the project and integrate them into development planning.

- Parts of the applications environment or infrastructure landscape are to be outsourced, i.e. an external service provider is to assume responsibility for applications development and provision and infrastructure provision and management. It is necessary to run scenarios to demarcate the services that are to be outsourced with respect to the costs, benefits, scheduling and risks. Interfaces may have to be redefined. The result must flow into development planning.

- A merger has taken place. Portions of the applications environment and infrastructure landscape are now available in duplicate. The systems have to be taken up and evaluated. Scenarios for the future design of the IT landscape are to be developed as a basis for consolidation.

Why is it necessary to develop scenarios at all? Isn’t there an easier way? Just as with all complex planning tasks, the practice of developing scenarios has also proven itself when it comes to EA development. A development plan is itself developed from the current state (and perhaps in keeping with the establishment of various premises) into several planning scenarios. This scenario technique offers advantages associated with the illumination of various aspects of the planning task from a number of perspectives and with it the generation of more complete and thus lower-risk solutions.

The standard starting point is a weakness analysis, either the continuously run analysis in connection with EA development or a special adapted weakness analysis. In the context of EA planning, it will be necessary to use the findings of the analysis in order to determine strategies for eliminating the weaknesses. Here, it is important to include the following:

- The results of the weakness analysis
- Empirical data on the deployed reference architecture models
6.3 Developing Planning Scenarios

- Market information (products and reports from analysts, institutions, organizations, users and manufacturers)
- Requirements and initial conditions (functional and non-functional requirements)
- Costs
- Risks
- Deadlines

In addition to this, the development planning is also required to consider current projects and the new projects contained in the project portfolio. The to-be EA model develops from the optimization measures that are initiated in the context of strategic architecture management, the current maintenance measures, and projects. It is often not possible to set up optimization measures as projects in their own right. Instead it is necessary to implement them in the framework of projects and maintenance measures. Here, development planning is assigned the important task of synchronizing the projects and maintenance measures initiated within the departments with the optimization and elimination of weaknesses. To highlight the connection here, I refer again (Figure 6-2) to the diagram of IT management processes shown in Chapter 2.7:

Figure 6-2: Synchronization of Measures in the Development Plan

Moving targets

Planning scenarios are developed and continuously adapted on the basis of this information. EA requires continuous updating. This does not only refer to its current state, but also to hypothetical models, given that these, too, may also need to be re-
vised in light of changing circumstances. We have maneuvered ourselves out into rather volatile territory. The reasons for necessary adaptation in the EA’s as-is and future states are many: market and business changes, new business requirements, organizational changes, new technologies, enterprise expansion, etc. What is required is flexibility, quick responses to moving targets or, even better, agile EA, being on the uptake for changes and thinking ahead.

This requires a very close connection to ones IT clients: the organization’s departments. EA is required to operate very close to the business environment and requires precise information about it. This is the condition for agility and governance. This is why EA cannot be run as a project, but has to be a discipline in its own right, a process.\(^\text{20}\)

### 6.4 Evaluating Planning Scenarios

The development of planning scenarios usually gives rise to a number of variants that will have to be evaluated in order to determine the best to-be model. Figure 6-3 below offers a sample of main categories for suitable evaluation criteria.

\(^{20}\) A project with this as its subject would only be advisable for the initial introduction of EA and architecture management, with the results then being transformed into an independent unit.
6.4 Evaluating Planning Scenarios

Figure 6-3: Evaluation Criteria for Planning Scenarios

Figure 6-4 below shows us how an evaluation of these criteria leads ultimately to the identification of a best scenario.

Figure 6-4: Evaluation of Scenarios

Figure 6-5, 6-6 and 6-8 below illustrate the as-is and to-be models in the EA in the context of our product-process application system matrix.
The validity period changes in the to-be model are highlighted. The juxtaposition of the two models underscores the planned change in the application environment over time. This is also reflected in maps of the infrastructure landscape.
6.4 Evaluating Planning Scenarios

As indicated in Figure 6-7 below, it would also be possible to create views in which the changes created by a project are made visible.

Figure 6-7: To-be Model (per project)
6.5 Planning Development Measures

After selecting the best development scenarios, it is important to plan the development measures. The gap analysis helps us to determine the routes that we will have to travel to arrive at the goal. It shows us the distances between the EA's current state and a planned state, what degree of difficulty the particular route has, what fruit can be picked along the way and what sightseeing attractions await us.

The elimination of the gaps is expressed in measures that can be evaluated in terms of their complexity, potential benefits, and associated opportunities to score quick wins in a portfolio. Figure 6-8 below illustrates the corresponding priority derivation of the implementation measures.

**Figure 6-8: Evaluation of the Measures**

- product server
- website
- multilanguage support
- intranet
- infrastructure consolidation
- standardized CRM
- product development
- vertical integration
- Sales - Asset
7

Implementation: Developing Enterprise Architecture

Architects must work with their heads in the clouds and their feet on the ground

It is the IT architects who are called upon to forge the first link between strategic planning and operative implementation when it is a matter of the development of the enterprise architecture (EA), when the strategic development planning is to be implemented, and when IT governance is on the agenda. What are the consequences of this task for the organization of the architecture management? How can we secure the thorough transformation of strategy into operative systems? What do the accompanying processes and boards look like? How do we secure results? What are the procedures and tools that will help us to do so?

What requirements can be derived from these considerations for the IT architect? The above quote compellingly captures the necessity of planning on the basis of a broad strategic vision and analyzing and acting at the basis, i.e. in the operative business. The IT architect is obligated to present the expedient solution without thereby neglecting to account for the solution’s impact and broader planning objectives.

In the present chapter, I attempt to offer you a broad view of EA implementation. The focus here is on methods, procedures, processes, and organizational forms that help us to transform the specifications that result from EA documentation, analysis, and planning into operative reality. Comprehensiveness and a sense of obligation are important principles to heed when it comes to EA implementation and management.

7.1 Translating Strategy into Operative Reality

One of the most significant challenges for the establishment of a functional architecture management lies in the task of overcoming the gap between strategic planning and operative implementation. Architecture management is required to master the balancing act illustrated in (Figure 7-1) below:
• Staying close to the IT and enterprise strategy while picking up on business development and IT guidelines and introducing knowledge of technological trends, business cases, emerging standards and enabling technologies

• Staying close to projects, generating expedient solutions, cutting off lengthy discussions of architecture alternatives, supporting methods, introducing guidelines, implementing strategies, and gathering and evaluating experience

![Figure 7-1: Converting Enterprise Strategy into Operative Measures](image)

This represents how an architecture management can be lastingly effective for the benefit of the entire enterprise. But this is often exactly the stage of failure. As a discussion participant at one of our architecture management conferences once put it so trenchantly: "On the one hand, I am very successful with my architects. They are accepted in projects, vigorously sought out and often seldom released. 80% of the department output can be balanced by projects. On the other hand, I seldom see my people anymore. Feedback from the projects is lacking, the accumulation of person-independent experience is not taking place. And strategic enterprise architecture planning? An untilled field!"

This corresponds roughly to the situation in many established architecture management organizations, a firm basis in the operative business of software and system architecture design, person-dependent, little standardized in terms of methodology and result types, inadequate efficiency. There continues to be no professional designation to define the activities of the IT architect, no
7.1 Translating Strategy into Operative Reality

academic curriculum, and no established methodologies that are broadly accepted and applied.

Many enterprises struggle with the other extreme: architecture management is regarded as a planning discipline, an extension of the portfolio management. Here, the focus is on strategy as a guideline for development planning. But how are the plans implemented? Who takes care of the architecture of individual systems when the development planning is complete? Who makes sure that the modeling decisions conform to the big plan? Documentation and EA planning with the status of a staff headquarters and without a basis in the operative business tends to remain ineffective - planning without implementation and documentation of what was implemented in projects without considering a strategic plan.

The aim of an effective architecture management organization must be the bridging of the gap between strategy and implementation. This is why the accompanying processes are required to harmonize operative and strategic elements and possess defined interfaces. As illustrated in Figure 7-2 it will be necessary to synchronize the processes of strategic architecture management and operative architecture management:

**Strategic Architecture Management**
- Planning and developing EA
- Planning and developing the application environment
- Planning and developing business architecture

**Operative Architecture Management**
- Planning and developing software architecture
- Planning and developing systems architecture

21 A detailed description of the above-mentioned processes would go beyond the scope of this book. For more in this regard, readers may wish to refer to the website for this book www.unternehmensarchitektur.de and the rubric toolbox for enterprise architecture management (ACT2004).
7 Implementation: Developing Enterprise Architecture

- Planning and developing reference architecture
  This constitutes a prerequisite for the creation and sustained development and maintenance of an EA pyramid.

![Diagram of Strategic and Operational Architecture Management](image)

Figure 7-2: Strategic and Operative Architecture Management

### 7.2 Establishing Strategic Architecture Management

It is incumbent on a strategic architecture management to fulfill the task of defining the EA as a whole. The business architecture must be determined and continuously updated. The specifications issued by requirements and portfolio management (projects and maintenance plans) must be synchronized to the results generated by applications landscape analysis and integrated into development planning.

The sub-process of planning and developing EA involves the following:

- Determining the EA’s structure, content and visualization (Document!)
- Defining the methodologies and processes of architecture management
- Determining the organization of the architecture management
7.2 Establishing Strategic Architecture Management

The sub-process of planning and developing the applications environment involves the following:

- Determining and applying the evaluation procedures (Analyze!)
- Developing EA scenarios and planning states (Plan!)
- Defining measurement procedures and key performance indicators (KPIs) (Check!)

The sub-process planning and developing business architecture involves ascertaining the elements of the business architecture and preparing them for documentation and maintenance in the EA. These elements include:

- Goals, strategies, initial conditions, risks
- Business processes
- Products
- Organizational units
- Services and components

The strategic architecture management is responsible for the drafting of a development plan that represents both the current state of the applications portfolio and the relevant planning states. The basis for the development of planning states comprises analyses of the current applications portfolio (e.g. with respect to technical quality or the load-bearing capacity of the architecture), the interfaces and the operational coverage. The strategic architecture management is responsible for the efficient deployment of IT resources and extending the portfolio management in order to make the best of both new projects and the existing applications portfolio.

The strategic architecture management concentrates on the optimization of existing IT support for business processes.

Strategic architecture management is not responsible for requirements management and the prioritizing and budgeting of new projects and maintenance initiatives. As illustrated in Figure 7-3 below, the requirements and portfolio management works closely with the strategic architecture management:

- The decisions made by the requirements and portfolio management flow into development planning.
The results of the analysis of the applications portfolio support the structuring of the project portfolio.

Figure 7-3: Interface: Architecture Management and Requirements and Portfolio Management

The linking of requirements and architecture management helps us to determine the right basis for IT measures in the business. The often encountered effects of a mistaken application (Brilliant Solution! But nobody needs it!) frequently stems from a lack of alignment between housekeeping and new construction. A holistic consideration of system requirements, technical optimizations, synergistic effects, deficiencies, and risks is necessary.

7.3 Establishing Operative Architecture Management

The operative architecture management is responsible for the implementation of specifications issued by the strategic architecture management relating to projects and line work. In light of the fact that software and system architects are responsible for delivering solutions, they are referred to in some organizations as solution architects. They pick up directions that are issued by strategic planning and make sure these are transformed into operative reality. In addition to this, they issue feedback from
7.3 Establishing Operative Architecture Management

In addition to this, they issue feedback from their work to the strategic architecture management. Using their experience, software and system architects lay the foundation for the definition of reference architecture models and deployment scenarios. They develop and specify new architecture scenarios wherever necessary and present their drafts to an architecture board for purposes of consultation and review. Software and system architects help to ensure convergence in all architectural developments in the organization and combat overgrowth and heterogeneity.

The sub-process planning and developing software architecture describes the work of the software architect in the project and line:

- Ascertaining all parameters that influence architecture decisions (e.g. quantity structures, requirements, initial conditions)
- Selecting suitable reference architecture models or developing new architecture scenarios
- Developing (i.e. as necessary) technical prototypes
- Evaluating architecture scenarios
- Submitting architecture specifications and decision criteria to the architecture board
- Implementing architecture specifications (Act!)

The sub-process planning and developing system architecture involves all of the tasks that are to be performed by system architects in project and line work in order to implement the strategic specifications for the infrastructure:

- Supporting the software architects in the ascertainment and evaluation of architecture-shaping parameters
- Planning technology deployment for projects and line initiatives
- Providing consulting services in matters of technology
- Providing support for technical prototypes
- Submitting architecture specifications and decision criteria to the architecture board
Planning and Developing Reference Architecture

- Providing support for technology projects (Act!)

The sub-process planning and developing reference architecture models involves all of the tasks that are to be performed by software and system architects:

- Identifying and drafting specifications for development lines
- Evaluating development lines and supporting enterprise architects in consolidation tasks
- Deriving and drafting specifications for reference architecture models
- Deploying and developing reference architecture models (Act!)

The operative architecture management is directly involved in current projects and maintenance initiatives. It thereby renders services for the program and service management. Operative architects (i.e., solution architects) must be obligated to present solutions and to synchronize the architecture management to the program and service management. Figure 7-4 below shows us the interfaces of the EA management:

- The link to requirements and portfolio management is established via strategic architecture management.
- Program and service management is linked via operative architecture management.
7.3 Establishing Operative Architecture Management

Figure 7-4: Strategic and Operative Architecture Management in the IT Strategy Framework

The top processes of the IT strategy framework are synchronized via these interfaces. Operational requirements are ascertained and structured in requirements management. The architecture management is responsible for the housekeeping and for EA documentation, analysis and planning. The decisions made by requirements management and architecture management flow (under the direction of IT strategy) into portfolio management whose decisions, in turn, flow into development planning. Program and service management are responsible for the subsequent implementation in projects, programs and lines. As illustrated in Figure 7-5 below (a repeat of Figure 6-2), the transformation of business and IT strategy into operative reality is managed in the context of the governance process.
Figure 7-5: Synchronization of IT Management Processes
7.4 Establishing an Organization

Enterprise architecture (EA) management requires a stable and binding organizational structure. For just as the establishment of genuine governance is not a matter of performing a one-time task, EA is not a monument that is constructed once and then left in a static state. The information system behind the governance process will have to be continuously maintained and updated so as to enable informed navigation and action at all times.

The following items belong to the construction of this organization:

- Definition and binding introduction of the architecture management processes discussed in Chapters 7.2 and 7.3
- Development of a line organization for strategic and operative architecture management
- Certification of IT architects

Introducing Architecture Management Processes

IT architects are often stereotyped as being methodical individuals who like to keep track of model development and processes and to monitor adherence to them. There is nothing alarming about this characterization, so long as the purpose remains in focus and the methodology is not allowed to become an end in itself. After all, such properties can help to ensure reproducibility and reliability in the IT process. However, when questioned about the processes, procedures and methods that underlie their own work, the response of the architect is often one of silence.

This point is not trivial because the establishment of an architecture management organization that effectively supports IT governance depends on defined, person-independent and reproducible processes! If one goes off in search of standards in this area, the typical response is: the good thing about the standards is that there are so many of them. It is essential to select one of the common architecture management frameworks (see Chapter 7.5) and adapt it to ones own needs or to define the processes on ones own.

In the end, what counts is the result: the processes of strategic and operative architecture management that are introduced must have a binding character. Avoid lengthy discussions, exploit the thrust that is offered by predefined frameworks whenever possi-
ble. There is no subject that is likely to trigger lengthier discus-
sions among IT professionals than architecture!
The determination of methods, tools, objectives to be reached, roles and standards goes hand in hand with the definition of the processes.

**Developing Line Organization**

The organization of the EA management is oriented towards the tasks that are to be handled by the strategic and operative architecture management. A firm basis in IT management in harmony with portfolio and requirements management is required for the strategic assessment of responsibilities. The operative impact unfolds in association with the service and program management where the application of architecture to projects and line tasks takes place. The size and complexity (spatial distribution, organizational structure) of the overall IT organization will determine the form that is suitable for the architecture management organization.

As indicated by Figure 7-6 below, small and less complex IT organizations will tend to favor a centralized organization in which architecture management functions as an independent organizational unit in the line or in the staff. Here, strategic and operative tasks are handled together. One should make sure that efforts to handle strategic tasks are not squelched by the need to attend to daily business.

![Centralized Architecture Management diagram](image-url)
7.4 Establishing an Organization

As illustrated in Figure 7-7 below, the architecture management can also be diversified. Strategic and operative functions are separated organizationally. This lowers the risk of having strategic functions squelched. The communication between the organizational units is the crucial point here. This will have to be the subject of formal regulation and will have to be binding. If this organizational form is applied to larger IT units, it may result in the need for operative architects to specialize in particular IT task areas.

![Figure 7-7: Diversified Architecture Management](image)

Large IT units tend to favor a form of distributed architecture management (see Figure 7-8) in which the operative architects report directly to the IT units (which are assigned, e.g., to business units). Strategic architects are located in the middle of the team. While the communication between the operative and the strategic architects is even more critical in this setup, the clout of the operative architects increases. Barriers between strategic and operative architects can be lowered by rotation, which also lowers the risk that the strategic architects will become denizens of the ivory tower. In the case of this organizational model, it will be essential to ensure that consolidation and reuse also takes place beyond the borders of the IT unit.
Very large and complex IT organizations prefer a form of decentralized architecture management in which both strategic and operative architecture management functions are located in the respective IT units (see Figure 7-9). This model makes it more difficult to propagate consolidation and reuse beyond IT-unit borders. As a consequence, it can only be combined with an approach that effectively turns the IT units into solution, profit and cost centers.

There are naturally also hybrid forms of this organizational type. Consider the following example (HAG2004):

- Central architecture department with around 40 architects who are specialized in the areas of applications, technology, security, and systems management and integration, and whose main area of concern is development planning (although they also work about 30% of the time in projects)
7.4 Establishing an Organization

- Around 20 domain architects (each of whom is responsible for a functional application area) who spend half of their work time addressing central architecture issues and their application domains.
- Around 10 lead engineers each of whom is responsible a technical domain.

In addition to establishing the organizational form of the architecture management, it will also be necessary to determine the necessary human resources. One often hears either that strategic architecture management should account for around 0.7 to 1% of ones entire IT staff or that it should be comprised of a team of 5 - 7 persons (KEL2004). Ample confirmation for these figures is available in the literature: “Forrester found that 84 percent of companies it surveyed had centralized enterprise architecture groups of fewer than 10 people, regardless of company size.” (KOC2005)

The available HR figures for operative architecture management show considerable variance. Higher HR estimates tend to correspond to periods involving large projects. It is often the case that the lines of demarcation between operative architects, senior developers, technical project managers, systems specialists, etc. are unclear due to a lack of defined processes and roles. This makes it more difficult to determine exact (and commensurable) HR needs. Our own figures show that the area of architecture accounts for an average of around 3.4% of total HR capacity in IT (see Figure 7-10, ACT2003). This figure reflects the needs for both strategic and operative architecture management.

Experience shows that the work of IT architects in small organizations tends not to be institutionalized and that the accompanying roles are not defined. This suggests that much architectural work is done without being classified as such. This offers an explanation of the below average HR figures that turn up in smaller IT organizations.
It thus seems safe to assume that an average of around 2.5% of total HR capacity in every IT organization is accounted for by architectural work, i.e. even if the work is not specifically referred to as such. What are involved are operative architecture management tasks in the areas of applications and systems architecture. The establishment of a strategic architecture management and the development and maintenance of EA as an instrument of navigation for IT governance will require a 0.7 to 1.0% increase in HR in the area of IT.

Certification of IT Architects

In the 1980s, the staff of a large German manufacturer of computers used the following quip to explain their certification process:

How do you train candidates to become project managers? You throw them into a pool of cold water. How do you train candidates to become good project managers? You let the sharks in.

While the certification process for IT architects today continues to resemble the above process, there is currently a great deal of
movement in this area. Universities have responded by revising their curricula, training institutes have responded to the new market, technology-oriented training programs in J2EE and .NET have been re-labeled and now bear a reference to architecture, and organizations such as the OpenGroup have begun to offer certification programs (www.opengroup.org) or are moving in this direction (www.geao.org).

While these developments represent a good start, and you may have the good fortune to select an appropriate program, they are not sufficient.

The IT architects I have referred to in this book are primarily responsible for ensuring implementation (Isn’t it nice when things just work?). But while they are well-versed in matters of implementation, they also have a keen eye for essential matters and strategic planning. Architects must work with their heads in the clouds and their feet on the ground.

This presupposes a sound understanding of business concerns, a knowledge of the organization and business processes, and an understanding of business strategy. This is also based on considerable experience in the area of IT. The necessary profile is more that of a generalist than a specialist. One will have to have the knowledge and experience to ask the right questions, to identify the parameters of an architecture decision, to ascertain the requirements, and to grasp the initial conditions. In addition to many other formal qualifications that are established in role profiles, these are all requirements that are to be met by IT architects (ACT2004). The above-mentioned requirements point out a practice-based qualification for the IT architect: on-the-job training.

We can now either find a way of letting the sharks in or take a more civilized approach via defined architecture management processes (see Chapters 7.2 and 7.3). If you have access to these definitions, then your IT architects can acquire missing qualifications via training on the job. This can be supplemented by focused coaching by experienced colleagues and mentors, defined methods, checklists and standards. Attaining virtuosity in wielding the instruments of the IT architect is a matter of practice and focused instruction. The obligation to achieve standardized results is more effective in this regard than the standardization of procedures. Define your processes with this in mind and use

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these as a foundation for an IT architect curriculum. Then your architects will be able to swim with sharks.

### 7.5 The Costs of an Enterprise Architecture

In the previous chapter I indicated that an EA management will account for around 0.7 – 1% of overall HR budget for IT. This allows us to derive the running HR costs for a strategic architecture management. CIO Magazine estimates an amount “between $650,000 and $1 million per year for four to six full-time architects.” (KOC2005) In exchange, we get a continuous remodeling of the EA, a continuous production of EA analyses and plans, and continuous input for operative implementation in the form of initiatives and projects.

The establishment of EA is usually carried out by a small team that may be supported by external consultants. By the end of an overall planning phase of around 3 months, this project team should be able to provide an initial EA model, and then complete this model, introduce processes and methods, establish the organization, the tool environment and the necessary know-how, determine indicators and establish the IT governance processes in another 9 – 12 months. This may then be followed by a roll-out in further corporate units.

The duration and expense will depend on the following factors:

- Complexity of the applications environment (size, degree of heterogeneity, degree of integration, spatial distribution)
- Scope and quality of available models and documentation
- Scope and quality of tool support
- Scope and quality of methodological support
- Requirements and demands
- Degree of support within the organization

The above estimates have been confirmed by a study carried out by the Meta Group. The study’s results indicate that the average time required to establish EA is 14 months. (PRA2002)

In addition to the HR costs for setup and running operations, it will also be necessary to consider material costs for frameworks and tools as well as training and consulting costs. Given that the cost structure can only be ascertained in the concrete case (i.e. Setup time: 12 - 14 months).
starting positions and targets can vary widely), one can only provide a reference estimate of costs.

What is clear is that such an undertaking will involve both a substantial investment and running costs. But what is the price of having no structured and permanently analyzable EA? This question will certainly not really help us to make a decision, but it is a legitimate way of putting things in perspective.

For instance, consider the aspect of security and risk management that I described earlier as one of EA’s essential benefits. A comprehensive household insurance policy represents an instrument of risk management in one’s private sphere. Few of those whose household belongings are of high monetary value question the utility of such an insurance policy. The costs associated with risk management are clear and acceptable. It is only after we have weighed the risks and decided in favor of purchasing a policy that we consider the question of which policy offers the best value. Naturally, if the costs of the policy were themselves high enough to create a significant cash flow risk, then we would probably opt against the policy.

But what are we to make of a decision making process that includes an attempt to assess the risk involved only after the price for the risk management is right – the price for the management of a risk that has not yet been identified and operationalized?

A look at the other two benefits of architecture management also reveals comparisons that speak in favor of gaining a different perspective on the subject. No one active in the modern construction sector would call into question the necessity of plans both for city development and for the construction of a single-family residence. Everyone knows that these plans are necessary (necessary, but not necessarily sufficient) for the optimal deployment of resources. And no one doubts that such plans are helpful when it comes to the right (i.e. needs-oriented) development. Would it be better to return to medieval construction practices in a modern and densely populated industrialized country? In the case of the construction sector, we have clearly learned from the centuries of practice that plans help us to proceed efficiently and effectively. And if you could, you would certainly not proceed as follows when it comes to the construction of your own home: if the architect and the civil engineer are not too expensive, then we’ll pay for the blueprint, otherwise we’ll probably get along okay without it.
But this is exactly how we proceed in the case of IT development. Major projects are started without an overall development plan. One makes a decision in favor of deploying a standard software package on a global base without having any idea how the integration, the migration, and the coexistence are to be secured. And when one inquires about these, the response is that they simply aren’t in the budget.

Greater transparency is required so that an EA management can create value, lower costs and minimize risks. In what follows, I would like to follow up on this issue by providing an outline of the costs and benefits.

7.6 The Benefits of Enterprise Architecture

There are many estimates in the literature of the cost-saving potential associated with consolidation, homogenization, and architecture management. IBM UBG Research and McKinsey assume cost savings of 20% as a result of the introduction of architecture management alone. (HAR2002) Robert Handler of the Meta Group asserts: “Our studies show, however, that those with governed enterprise architecture standards in place during this time-frame enjoyed a 30% reduction in end-user computing costs.” (HAN2004) Researchers at the A.T. Kearney consulting firm indicate savings of 15 to 20% in the area of computing center consolidation and suggest that infrastructure costs can be reduced by 20-30% solely by implementing architecture management measures. (ATK2002) The HVB Group (WEB2003) assumes a cost-saving potential of 25% via a thorough renovation (see Figure 7-11), including:

- Replacement of applications
- Consolidation of applications
- Use of standard software
- Standardization of technologies
- Lifecycle management
- Streamlining of IT processes
The savings are typically estimated at between 20 and 30%. However, what is our response to those who are not satisfied with the empirical assessments of the analysts concerning the cost-saving potential associated with EA and who are also not convinced by my case studies and who demand specifics relevant to their own situations, and otherwise insist on concrete figures?

I would like to attempt to provide the numbers by way of concentrating on increased efficiency. For how are we to measure the value of business alignment, how are we to grasp what develops in terms of additional asset productivity. This is exactly the recommendation of the Gartner Group when it comes to determining the value of EA. (LOP2002) Measurements of security are also controversial. What is the value of the potential losses against which EA protects us? What is the value of a failed project? What was its budget? How much time was lost? And the budget overruns? Misdirected investments?

I am indebted to W. Keller for the principle behind the following calculation (KEL2004):

**Premises:**
- HR costs as a percentage of total IT budget: around 30% (GLO2003)
7 Implementation: Developing Enterprise Architecture

- Costs for Team Enterprise Architecture: around 0.7% of total IT staff (KEL2004, ACT2003)
- Savings potential via architecture management 3.5% (KEL2004, ACT2003)²²

Conclusion:
Given annual costs of 0.21% of the IT budget (0.7% of 30%) a savings of 3.5% for the entire IT budget are achieved. This effect arises from EA management alone thanks to the consolidation of development lines and infrastructure.

The cost-benefit ratio for establishing an EA management thereby comes in at 17:1.

Is it possible to underpin this calculation with practical empirical data? Here, I would like to draw upon the results of what is likely the most extensive of all evaluations of EA programs, an evaluation that the General Accounting Office (www.gao.gov) drafted in the wake of its supervision of U.S. federal agencies. Given that the U.S.-American agencies have been obligated since 1996 (i.e. following the passage of the Clinger-Cohen Act) (CCA1996) to establish an enterprise architecture management, this report contains figures that are based on several years of experience with this subject.

An overview of the costs and figures on the benefits from the enterprise architectures of diverse U.S. agencies are contained in this report sponsored by the GAO (HIT2002). David Frico²³ has assessed the figures. The table below is based on his results (Figure 7-12). For each of the relevant agencies Frico compares the accumulated costs of the EA program (as ascertained by the GAO) to the quantified benefits (savings, optimizations, avoided losses from risks). The cost-benefit ratio comes in at an average of 27:1, with the return on investment coming in at 2553%. The breakeven for the EA program was reached on average after only 3 months.

²² The above-mentioned savings potential of 20 - 30% was reduced to a practical measure and to the effects that are clearly to be assigned to the architecture management.
²³ www.davidfrico.com
7.7 Resources: Frameworks and Tools

I have described EA as a structured collection of plans. A framework for EA does not supply us with reference plans, but with a framework for the organization of plans and their development. Depending on its scope and orientation, such a framework may specify various aspects of EA:

- EA principles
- Processes for setting up and using EA
- Methods of analysis and evaluation, sample results, standards, tool specifications and responsibilities
- The structure for modeling EA in the form of a grid or a metamodel
- Organizational rules (e.g. pertaining to the establishment and responsibility of committees)

In an EA framework, you will find, for instance, templates for development plans, analysis and evaluation procedures for the application environment, planning procedures, key figures and key performance indicators, samples for the specification of reference architecture models with respect to functional deploy-
ment scenarios, process models for the development of development plans, the planning of application and system architecture, the derivation of reference architecture models and the modeling of business architecture.

**The Zachman-EA model**

The classic EA framework is the Zachman Framework (ZAC1987) (see Figure 7-13). This model shows various EA sub-models in a matrix whose columns contain subject areas such as dates, functions, networks, people, time, and motivation. The various rows show the specific views for stakeholders, including planners, owners, designers, developers, and suppliers. Each row in the matrix thereby contains a model that shows information on specific issues at a level of detail that is exactly adapted to the needs of the relevant stakeholders.

**Accelerating the establishment of EA**

Given that they contain many necessary elements in a pre-finished form, the use of EA frameworks can significantly accelerate the establishment of EA. The framework enables one to promote standardization, regulate processes and methods, and establish independence from individual persons.

**Professionalizing IT architecture processes**

IT architects demand that the projects they support exhibit ordered procedures, standardized documentation and methodical work. If one asks the IT architects themselves about the methods, procedures and documentation standards they use, the response is often one of silence. The professionalization of IT architecture processes, person-independent reproducibility, and process management are urgently necessary. These are exactly the objectives that architecture management frameworks enable one to fulfill.
However, frameworks do not make architects obsolete, they do not automate architecture production. Frameworks accelerate and standardize the process. The following remains the case: architecture takes place between two ears. Experienced, qualified and accepted architects represent a necessary condition for a successful EA program.

The currently available frameworks have different orientations. Some are especially geared to specifying EA structure, others are geared to facilitating architecture management processes. Some also contain information and best practices concerning the organization of the architecture management. The table in Figure 7-14 below offers an overview of a number of common frameworks.24

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24 For more information, readers may wish to refer to the relevant links at www.unternehmensarchitektur.de and in SCH2004. A more in-depth discussion of this subject would go beyond the scope of this book.
### Figure 7.14: Architecture Management Frameworks

<table>
<thead>
<tr>
<th></th>
<th>Zachman</th>
<th>TOGAF</th>
<th>FEAF</th>
<th>t-cam</th>
<th>C-4ISR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
<td>Originator of frameworks</td>
<td>The OpenGroup model</td>
<td>The enterprise architecture model used by government agencies in the United States</td>
<td>Process models for strategic and operational architecture management, meta-model for enterprise architecture, organizational model for architecture management</td>
<td>The enterprise architecture model used by the DoD</td>
</tr>
<tr>
<td><strong>Structure</strong></td>
<td>+++</td>
<td>+</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td><strong>Processes</strong></td>
<td>+</td>
<td>++</td>
<td>++</td>
<td>+++</td>
<td>++</td>
</tr>
<tr>
<td><strong>Organization</strong></td>
<td>+</td>
<td>++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
</tbody>
</table>

7.7 Resources: Frameworks and Tools

In addition to frameworks that describe the processes, structures and organization of an EA management, tools for purposes of EA documentation, analysis, planning and measurement play an important role. The table in Figure 7-15 below offers an overview of the most common tools.25

<table>
<thead>
<tr>
<th>Explanation</th>
<th>CASE Origin</th>
<th>BPM Origin</th>
<th>Enterprise Architecture Origin</th>
<th>Dictionary Origin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development of classic CASE-tools, IT-driven modeling</td>
<td>Development of classic business process management (BPM) tools, functionally driven modeling</td>
<td>Specialized tools for enterprise architecture, portfolio management and/or IT management</td>
<td>Development of dictionary systems, focused on documentation and not on modeling, analysis and planning</td>
<td></td>
</tr>
</tbody>
</table>

- **Strengths**
  - Many predefined diagram types and reports from the areas of business, application and system architecture
  - Many predefined diagram types and reports from the area of business architecture
  - Specialized models for EA tasks (e.g. development planning); analysis procedures for the enterprise architecture
  - Considerable detail

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25 For more information on architecture management tools and a catalogue of criteria for evaluating tools, readers may wish to refer to www.unternehmensarchitektur.de. A more in-depth discussion of this subject would go beyond the scope of this book.

Klaus D. Niemann, From Enterprise Architecture to IT Governance, ISBN 3-528-05856-0
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### CASE Origin

**Weaknesses**
- Minimal flexibility (adaptation of the model, analyses)

**Examples**
- Popkin, CASEWISE, Pro-forma

### BPM Origin

**Weaknesses**
- Minimal flexibility (adaptation of the model, analyses)

**Examples**
- MEGA, ARIS, ADONIS

### Enterprise Architecture Origin

**Weaknesses**
- Complexity

**Examples**
- alfabet, Metis

### Dictionary Origin

**Weaknesses**
- Complexity, lack of support when it comes to analysis

**Examples**
- ASG Rochade

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**Figure 7-15: Architecture Management Tools**
Safeguarding: Controlling Enterprise Architecture Development

Work expands to fill the time available for its completion (Parkinson’s Law)

What is the best plan worth if one does not succeed at controlling its implementation? What is the benefit of identifying consolidation potential (e.g. in the case of development lines) in one’s organization if it is left unexploited, if reference architecture models are not specified and introduced as obligatory? What is the value of eliminating redundant development lines if the capacity that is saved is not sensibly re-channeled, for instance, in order to reinforce the innovative strength of one’s IT unit? We have all seen Parkinson’s Law at work in organizations. The law states that work has a tendency to fill up the available time. This means that savings can only be realized where other useless activities do not fill up the space that was previously occupied by superfluous development lines, infrastructure components or the misguided projects!

This requires the measurement of performance, the checking of key performance indicators (KPIs), and the evaluation of progress. Architecture management must be made measurable, enterprise architecture (EA) must be furnished with performance indicators. This presupposes an understanding of architecture that is closely tied to the mission of the whole, and does not put the focus on system elegance, but on practical expediency.

The tenets of architecture that Vitruvius postulated to Emperor Augustus in the year 25 BC are often quoted in training programs for IT architects:26

- Utilitas: utility, serving of purpose

26 Approximately in the year 25 BC, the Roman architect Marcus Vitruvius Pollio presented Emperor Augustus ten scrolls that were supposed to contain everything he knew about architecture.
8 Safeguarding: Controlling Enterprise Architecture Development

- Finitas: stability, durability
- Venustas: beauty

While some may argue that beauty will ultimately converge with that which best serves the purpose of a meaningful enterprise, what we are primarily concerned with here is fulfilling the purpose of a system.

This understanding is a condition for the successful establishment and deployment of EA. The utility for the enterprise inheres in the capacity of something to fulfill the purpose or mission of the enterprise. Architecture can be a vehicle of IT governance.

IT governance is currently a hot topic. But what does the mastery or control of IT mean in practice? The IT Governance Institute formulates its mission as follows:

“The IT Governance Institute (ITGI) exists to assist enterprise leaders in their responsibility to ensure that IT is aligned with the business and delivers value, its performance is measured, its resources properly allocated and its risks mitigated.”

Do we know what our current position is (perhaps also compared to that of our competitors) with respect to the alignment of our IT with our business and the value delivered by our IT? Do we measure the performance of our IT? Do we know if the associated resources are being properly allocated? Are risks being mitigated?

The descriptions of the anatomy of EA I have offered so far suggest that EA is no less than a powerful instrument that is capable of supporting precisely those tasks cited by the IT Governance Institute. EA sheds light on behalf of IT governance by delivering the current coordinates (documentation and analysis), the route (planning) and the navigational instruments (key figures) that are necessary for governance.

27 www.itgi.org, 12.3.2005
8.1 Processes

In the previous chapter, I described defined processes, defined result types, and defined responsibilities as conditions for comprehensive EA development. The definition of these factors and their binding introduction are also necessary for the safeguarding, management and control of this development. And this is often exactly the stumbling block. Processes and responsibilities are defined, the rollout takes place, training programs are implemented – and everything appears to be on the right track. But then situations arise in which success remains out of reach despite the fact that all of the prerequisites have been met. What is lacking in everything is a sense of the obligatory. Measurability, marketing, alignment and support are lacking. Important success factors have been left unattended:

<table>
<thead>
<tr>
<th>Critical Success Factors</th>
<th>Explanation</th>
</tr>
</thead>
</table>
| **Binding nature**       | • Processes are binding for everyone.  
• Development plan exceptions are permitted only when the subsequent correction of such sins is a part of the plan.  
• No top-down overrides. Architecture management is a part of IT management.  
• Ensure continuity during and after the project. Create an architecture management authority. |
| **Consultation and participation** | • All involved are to participate. They are to be brought on board.  
• Create opportunities for cooperation and influence.  
• Secure acceptance.  
• Promote communication among equals.  
• Avoid endless discussions. Those who want to have a say also have to cooperate. |
### Critical Success Factors

<table>
<thead>
<tr>
<th><strong>Critical Success Factors</strong></th>
<th><strong>Explanation</strong></th>
</tr>
</thead>
</table>
| Success orientation         | • Focusing on quick wins  
|                             | • Placing the aim in focus  
|                             | • The business is the driving force for the architecture.  
|                             | • Secure outstanding IT and expert qualifications in the team.  
|                             | • Break the project down into manageable parts.  
|                             | • First result in 3 months  
|                             | • Complete project, set up viable EA management in around 1 year. |
| Promotion                   | • Active communication policy  
|                             | • Illustrate goals, benefits, plans and progress.  
|                             | • Emphasize importance and urgency. |
| Support                     | • Support in IT management is indispensable.  
|                             | • Driving force must come from IT management.  
|                             | • Business mentors  
|                             | • IT employees must think in terms of enterprise architecture. |
| Agility                     | • Regular ascertainment of coordinates  
|                             | • Flexibility in the face of changed conditions  
|                             | • Active response to the changes |
| Measurability               | • The results of architecture management must be measurable. |

### Binding nature

The management of the enterprise architecture plays an important role in IT management: it is part of a trio with requirements/portfolio management and service/program management under the direction of IT strategy and governance. Would you stand idly by and do nothing as major projects begin to run astray? Would you accept the trumping of business-critical requirements in the project portfolio? Certainly not!
8.1 Processes

The road to hell is paved with tactical solutions

Why then do we encounter innumerable examples of major projects that were begun without any kind of development plan? Why are there always exceptions for so-called strategic projects whose consequences annihilate the efforts of the architecture management to secure homogenization?

Introducing architecture management with a binding nature to an organization also means prohibiting shielded areas, exceptions, and overrides. Be prepared to be obligated to act consistently. This will neither rule against pragmatic solutions nor restrict flexibility. It will, however, require that one keep one's eye on the goal and return to the charted course, even if it is sometimes necessary to take a detour.

Otherwise everything will remain voluntary or indifferent!

The binding introduction of architecture management will also have consequences for the IT architects themselves. Promised deadlines and services are to be held. The functionality and quality of results are to be secured. Reliability must be demonstrated.

Finally, the establishment of an architecture management authority is a clear sign of reliability. This enables one to secure post-project continuity. Architecture management is an integral part of the IT organization.

Reliability must be demonstrated.

Consultation and participation

IT professionals have a tendency to talk at length about architecture. Nearly all of those involved feel called upon to relate their own experience with the subject. At first glance, this promises to be a facilitating factor when it comes to establishing meaningful communication and consultation in the matter of EA. Appearance is deceiving in this case.

More talk, less action

Great interest does not necessarily entail great contributions. There is often more talk than action. It will be important to focus discussions and, if necessary, reduce the number of participants involved in consultation.

On the other hand, we are aware that it is important to secure the participation of all of those who are affected, to bring them on board, create opportunities to participate and have an influence, to secure acceptance, and to promote communication among equals.
Limiting the number of participants in the decision making process appears therefore to have the advantage of securing an essential degree of efficiency, but the disadvantage of undermining acceptance. This can be effectively reconciled by a self-regulating system according to which those who want to have a say are also required to join the effort!

When preparing to make decisions on the architecture management process an agreement is reached with the departments involved (application development, operations, etc.) that the participants be assigned to expanded project team in which they accept an obligation to work within the project to a certain defined scope. This prevents meeting tourism and creates a sense of belonging among the members of the expanded project team and helps them to approach the subject of architecture management as one of their own, to take it with them into their departments and establish a certain domino effect.

This enables one to reach decisions on architecture management processes and methods, and not just formally, but also to firmly establish them in the minds of the staff.

As already indicated on a number of occasions, the business is the driving force for the architecture. Immediately beneficial results or quick wins are necessary. EA is required to demonstrate in short cycles that it generates benefits (see Chapter 3), i.e. that it contributes to the efficiency, effectivity, reliability and security of IT. The architects will have to show that fulfilling system purpose is high up on their agendas, they will have to concentrate on low hanging fruits and make sure that solutions that have been developed once can be reused. Throughout the organization it will be necessary to overcome the not-invented-here (NIH) syndrome that is often responsible for the development of ever new solutions to solved problems (Figure 8-1).

EA creates transparency, provides references, devises means of navigation and thereby actively promotes the sensible redeployment of ideas, knowledge and components. It helps one to overcome the ultimately gratuitous tendency towards reinvention before reuse.
The qualification of the team also plays a crucial role when it comes to results. Make sure that the team has outstanding IT and professional skills.

It will be necessary to consider the results orientation success factor at the very outset of the architecture management’s development: a first model of the EA should be presented within 3 months and the project for the development of the architecture management should not take significantly longer than one year. The EA management is then to be established as an authority and as a continuous process. Breaking down the project of introducing EA and architecture management into manageable parts is therefore urgently necessary. Small steps, quick results, direct, regular and target-group-specific communication are closely tied to one another.

The goals of an EA initiative (see Chapter 3) are just as ambitious as the results are indispensable:

- IT efficiency
- IT effectivity
- IT reliability
- Transparency and governance

One cannot pursue these goals in the dark. Active communication is necessary: illustrate goals and benefits, plans and progress. Make the importance and urgency clear. Given that an EA initiative requires support at all levels, communication and marketing are essential parts of the overall effort.
The establishment of EA as an effective instrument of IT governance will require the support of the IT management. Moreover, given that an EA management is a part of the IT management, the driving force must come from the IT management. EA in the encompassing sense discussed in this book, which plays a part in the ensemble of IT management and effectively supports IT governance, cannot be developed from below. It must be spearheaded, supported and desired by the management and must be developed from the business.

This why having a mentor on the business side, preferably a member of executive management, can be so helpful. If the value of EA for the alignment of IT to the business is also recognized at the level of the executive management and promoted by the mentor, then one will have the green light.

But the support of the IT employees will also be necessary. It is only after the EA has been formally introduced and has taken hold in the minds of the employees that the medicine can begin to take effect. Here, support is available in the form of the above-mentioned contributions made by operative IT staff members in the expanded project team.

Accurate shooting at moving targets belongs among the daily routines of enterprise architects. This skill presupposes flexibility, regular position ascertainment, course adjustments, and rapid responses to changed circumstances.

Furthermore, a direct connection to the business, a profound understanding of the market and of the enterprise strategy permits enterprise architects to actively prepare for changes, to anticipate what is around the corner, and even to make helpful suggestions. Architecture management agility is in demand in times of volatile markets, strategies and conditions.

How am I to control what I cannot measure? How am I to chart or correct the course if I don’t even know what my coordinates are? Measurement procedures, key figures, performance indicators, benchmarks: all of these are indispensable for the professional steering of the EA’s development. This can frighten away many self-appointed IT architects whose self concept has thus far been limited to the beauty of architecture (venustas).

However, the key to success is the measurability of the EA. This enables one to determine the value that the application systems create for the enterprise, to measure heterogeneity and to assign costs. It is only with the help of measurable attributes in your EA.
that you will be able to create a genuinely helpful instrument of navigation for your governance.

Tom Gilb once made the point provocatively as follows: every figure is better than no figure when it comes to controlling IT processes. (GIL1988) We will still often run into limitations when introducing EA, we will determine that figures are either not available or not available to the necessary extent, but this is no reason not to begin.

**No EA without KPIs**

EA without measuring procedures, coefficients and key performance indicators is of little value. These not only provide empirical derivations of costs and benefits (thereby enabling one to better promote EA in ones own house), they also support the control of architecture management within the organization. Moreover, EA can only deliver effective support for the management of IT if it is operationalized. It will thus be necessary to develop the EA model in keeping with these requirements.

### 8.2 Boards

Who is responsible for approving a development plan? Who declares reference architecture for binding? Who defines compliance rules? Who checks architectural drafts in terms of their conformity with the reference architecture? Who checks technology projects for compliance with rules? Who injects project and line experience into the architecture management process?

These questions focus on the responsibility for reviewing, safeguarding and deciding. This represents a management task that is often handled in boards.

- Governance board
- Architecture board
- Sounding board

The IT governance board establishes guidelines for IT processes. It reviews development plans,\(^{28}\) approves reference architecture models and deployment scenarios, approves the definition of the set of infrastructure standards, sanctions internal IT investments...
(housekeeping) and considers all architecture and governance issues. The governance board is usually comprised of the CIO, the IT managers and the responsible enterprise architects. It defines the IT governance rules.

The architecture board reviews architecture-relevant projects and initiatives for compliance with the rules established by the governance board. The architecture board is usually comprised of representatives of strategic and operative architecture management, development and operations. The relevant responsibilities may be distributed across distinct business, applications and system architecture boards.

Not every project is truly architecture-relevant. Standard maintenance tasks, minor projects, and routine work are not subject to the review of an architecture board. The more deployment scenarios and reference architecture models are defined, the more the architecture management process is anchored in the minds of the staff, the less likely it will be that the architecture board will have to get involved. The criteria that are used to determine architecture relevance include:

- Size and scope of the project
- Expected duration
- Strategic significance
- Economic significance
- Technical complexity
- Operational complexity
- Degree of technical innovation
- Degree of operational innovation
- Expected change frequency
- Necessary scalability
- Functional and non-functional requirements
- Initial conditions (e.g. deadlines, resources, budget)

Once the issue of architecture relevance has been settled, the architecture board reviews, for instance, architectural project drafts for compliance with the defined reference architecture models. This requires a standard for the specification of architectural drafts. Figure 8-2 depicts a sample directory:
8.3 Measurement Procedures

The sounding board is a committee that is of great significance particularly during the phase of the architecture management’s introduction. The board is not responsible for reviewing or deciding anything. Its tasks centers on integrating the experiences, requirements, and knowledge available in the various IT units into the architecture management process. It is a forum in which all who would like to have a say can have a say so long as they also make a contribution. The board thus supplements the above-mentioned expansion of the project team. The sounding board offers feedback from project and line work for the establishment and operation of the architecture management process.

8.3 Measurement Procedures

I have described the EA as the information system of the CIO, an instrument of navigation for the IT governance process. However, in order to be able to reliably ascertain locations, detect position changes, and chart a course, one will have to have a coordinate system. The lines of latitude and longitude, the GPS coordinates of our governance course are derived from the key figures issued by our EA. The more comprehensive the EA is, the more key figures it will be capable of delivering for the govern-
COBIT®, the popular key figure system (ITG2000A), originated in the auditing sector and thereby evaluates more from an external perspective and ex-post. As soon as we have a continuously updated source of key figures, i.e. our EA, we can change over to continuous measurement and control from an ex ante perspective.

As shown in Figure 8-3 below, COBIT® measures in the following four dimensions:

- Planning and organization
- Acquisition and implementation
- Delivery and support
- Monitoring

![Figure 8-3: COBIT® Processes](image)

A total of 34 processes have been defined, with each specifying critical success factors (CSFs), key goal indicators (KGI), key performance indicators (KPIs) and classification of degrees of maturity towards the benchmarking of one's own organization.

The success factors for the process “Define a Strategic IT Plan” include, for instance, “All assumptions of the strategic plan have been challenged and tested.” The KGI includes “Percent of business units using strategic technology covered in the IT strategic plan”. And the KPI includes “Time lag between change in the IT
8.3 Measurement Procedures

strategic plans and changes to operating plans”. The classification of the degrees of maturity proceeds in stages:

0. Non existent
1. Initial /ad hoc
2. Repeatable but intuitive
3. Defined process
4. Managed and measurable
5. Optimized

On the whole, COBIT® offers us an extensive framework of key figures that can be deployed for purposes of measuring in the context of the IT management process. COBIT® tells us little about the source of these key figures, their administration and the questions where they are kept, how they are updated, and how they can be lastingly deployed for purposes of control.

This is exactly where our CIO management information system comes into play, i.e. the EA. EA supports measurement, ascertainment of ones position, and general IT governance on a continuous and lasting basis. EA offers the right space for the storage and provision of key figures for IT management.

The question remains as to how we are to begin and how we are to measure the progress of the architecture management? This process, which addresses EA development, is also in need of measurement and control. The architecture management scorecard shown in (Figure 8-4) measures this process in terms of goals achievement in the categories of efficiency, effectivity and reliability. In addition to this, the architecture management process is measured in terms of diffusion and execution.
Figure 8-4: Architecture Management Scorecard

The key figures in the architecture management scorecard can be successively expanded and, if necessary, refined with the help of COBIT®. Here, one should bear in mind that the costs of ascertaining and maintaining the KPIs are to be minimized. After all, the speedometer should not be more expensive than the motor! Moreover, the practice of ruling out (as far as possible) key figures that have to be obtained on the basis of subjective estimates or surveys has proven effective.

The development and application of the architecture management scorecard should proceed in top-down fashion, beginning from current tasks and their associated goals. It may prove necessary to establish new perspectives in order to monitor measures related to specific tasks. The weighting of the perspectives is dependent on the starting situation and task at hand. For instance, a high degree of heterogeneity in the area of infrastructure suggests a focus in the area of efficiency. Figure 8-5 below depicts an initial draft of an architecture management scorecard along with its KPIs:
### Figure 8.5: Architecture Management Scorecard Showing KPIs

<table>
<thead>
<tr>
<th>Category</th>
<th>Perspective</th>
<th>Measurement Topic</th>
<th>KPI</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goals</td>
<td>effectiveness</td>
<td>goal support</td>
<td>support of enterprise goals through application systems (%)</td>
<td>monthly/quarterly</td>
</tr>
<tr>
<td></td>
<td>customer perception</td>
<td>customer satisfaction regarding IT support</td>
<td></td>
<td>monthly/quarterly</td>
</tr>
<tr>
<td></td>
<td>efficiency</td>
<td>heterogeneity</td>
<td>degree of infrastructure standardization (no. of cells in infrastructure &quot;basket&quot; / no. of infrastructure components)</td>
<td>monthly/quarterly</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>degree of application systems' standardization (no. of functional business areas / no. of application systems) or (no. of cells in product/process matrix / no. of application systems)</td>
<td>monthly/quarterly</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>percentage of non-standard projects in total IT-budget</td>
<td>annual</td>
</tr>
<tr>
<td></td>
<td>complexity*</td>
<td></td>
<td>no. of interfaces between infrastructure systems</td>
<td>annual</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>no. of interfaces between application systems</td>
<td>annual</td>
</tr>
<tr>
<td></td>
<td>reuse</td>
<td></td>
<td>average no. of cells populated by one application system in product/process matrix</td>
<td>annual</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>average no. of application systems per reference architecture</td>
<td>annual</td>
</tr>
<tr>
<td></td>
<td>flexibility</td>
<td></td>
<td>average start-up time for highly innovative projects</td>
<td>annual</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>average amount of effort taken for technology evaluation processes</td>
<td>annual</td>
</tr>
<tr>
<td>Enabler</td>
<td>safety</td>
<td>deviation</td>
<td>percentage of projects in time and budget</td>
<td>annual</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>percentage of error correction costs rel. to total IT-budget</td>
<td>annual</td>
</tr>
<tr>
<td></td>
<td>error rate</td>
<td></td>
<td>no. of errors in systems not older than half a year</td>
<td>monthly/quarterly</td>
</tr>
<tr>
<td></td>
<td>EA process</td>
<td>diffusion</td>
<td>(no. of projects with architecture check / total no. of projects) or (total budget of projects with architecture check / total IT budget)</td>
<td>monthly/quarterly</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>no. of months since last architecture review</td>
<td>annual</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>percentage of architecture effort rel. to total IT budget</td>
<td>annual</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>percentage of cells in infrastructure &quot;basket&quot; where recent and future states incl. implementation plans are available</td>
<td>monthly/quarterly</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>percentage of cells in product/process matrix (alt. functional business areas) where recent and future states incl. implementation plans are available</td>
<td>monthly/quarterly</td>
</tr>
<tr>
<td></td>
<td>execution</td>
<td></td>
<td>no. of architecture requests (e.g. adressed to architecture board) pending, in progress, done</td>
<td>monthly/quarterly</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>average execution time for architecture requests or proposals</td>
<td>monthly/quarterly</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>average time from identification of new technology to decision on usage</td>
<td>monthly/quarterly</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>no. of educated (certified) IT architects</td>
<td>monthly/quarterly</td>
</tr>
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* i.e. communication capacity, measurement of inherent complexity needs appropriate metrics in software and infrastructure development processes
## Conclusion: Finding the Right Course

*Success is defined by the beholder, not the architect*

According to the current point total, the lively debate that took place in the year 2003 about the purpose and benefits of IT - a debate triggered by Nicholas Carr’s article *IT Doesn’t Matter* in the Harvard Business Manager - would seem to have been won by the proponents of the view that IT plays a crucial role in enterprise success.

However, this debate on paper does not suitably account for the actual requirements. The really successful organizations are those whose leaders have departed from the established canon at the right moment. The continual determination of one’s position and a willingness make course corrections are essential. Here, business orientation and a capacity to respond to business changes are the key. What is necessary is not stricter standards, but the tools and skills required for survival in an ever-changing environment.

**Business orientation**

IT agility and flexibility are also essential. The importance of IT can be measured in terms of its operative, tactical and strategic benefits. The absence of these will invite provocative theories such as that of Nicholas Carr.

**Agility**

This makes it all the more important to make the benefits of IT transparent and to secure its efficiency and effectivity. Like the various planning levels presented by the building architect show us the utility of each crossbeam, each water line and each roofing tile, enterprise architecture (EA) highlights for us the utility of every program, every application, and every administrative tool for the business functions of the enterprise. And it is in this same manner that EA enables us to carry out analyses, for instance, with respect to coverage, degrees of capacity utilization and complexity, costs, and dependencies. These analyses represent a foundation for an optimization of the existing environment in order to optimally exploit the existing environment before something altogether new is produced. EA is likewise a foundation for
agile maneuvering, flexibility and anticipation. It creates the basis for planning and enables us to develop and evaluate scenarios.

The documentation and maintenance of EA expands the basis for forward-looking planning, organization, and control of IT, i.e. for IT management. Analysis and planning on the basis of EA create transparency, which is the basis for consolidation, alignment and risk management.

The consolidation of infrastructure and applications environments presupposes a knowledge of the topography. Points of impact and dependencies must be detectable and gaps, redundancies, and cost drivers are to be identified. Securing these and bringing about consolidation on the basis of an analysis of the EA enables one to achieve a considerable reduction in costs.

Moreover, EA provides a management information system for effective IT management and creates the transparency necessary to meet future challenges. IT units are required to prove that their work is a value-creating asset, required to make an active contribution to transformation processes, and required to enable the enterprise to seize new opportunities in 6 to 12 months and thus twice as fast as the current rate. Alignment presupposes a knowledge of the current relationship between IT and business so as to enable an evaluation of this knowledge.

The transformation into operative reality must take place largely in the absence of risks. Mistakes can be expensive when it is no longer a matter of technological risks alone, but of ones capacity to develop new business fields and new business models. The anticipation, detection and management of risks presuppose knowledge and transparency. This can be achieved via the analysis and planning enabled by enterprise architecture.

Pursuing the right goal, following the right path and taking all of the necessary precautions for a safe journey is a matter of good steering. EA offers us the necessary transparency to secure efficiency via consolidation, effectiveness via alignment and security via risk management and is thereby a primary instrument of IT governance (see Figure 9-1).
The development of EA with an eye to achieving these goals represents the main objective of this book:

- Create transparency, ensure accessibility for the management, set up a management information system, the CIO’s radar screen.
- Enable analysis, derive new information from existing sources, prepare capacity to respond to new questions, ensure flexibility, and react to changes with agility.
- Develop views of the future, i.e. views that go beyond those of the current state to establish a foundation for target scenarios and plans.
- Focus on deployability and otherwise support the sustainable transformation of strategy into operative reality using the methods, organizational forms and tools of the architecture management processes.
- Ensure measurability and commitment as an effective basis for the management and control of strategic IT measures.

What have we left undone? Provide navigation assistance for the architecture management program? While concrete coordinates and stretches along our route can only be ascertained after de-
termining our position, the risks lurking along the way can be determined and mitigated.

**Disorientation**

There is indeed the risk of getting disoriented: lopsided orientation in favor of strategy or operative implementation. We have already seen the result in our case studies. Directing our EA to strategy alone is tantamount to planning without a sense of the operative, without our feet on the ground. We wind up with impractical solutions. Directing our architecture management to the operative alone, we risk losing our strategic control: housekeeping is neglected, the maintenance of IT assets takes a back seat to operative projects that are oriented to client wishes. Development planning, deployment scenarios and reference architectures are given short shrift and fail to facilitate convergence.

**Wrong level of abstraction**

And there is also the risk of flying at the wrong altitude, generating the wrong level of abstraction: either too detailed or too abstract. If we begin at too great a level of detail, then we suffocate in beauty, then we are no longer able to score quick wins and to prove what EA is capable of producing. If our approach is too abstract, then the results of our EA analysis will be worthless when it comes to navigation: the high altitude permits no ground orientation.

It is therefore essential to chart our course by keeping the goal in view, establishing the right balance between detail and abstraction and between the strategic and the operative (see Figure 9-2).
Figure 9-2: The Right Orientation and Degree of Abstraction

Figure 9-3 below shows the consequences of losing sight of the goal and merely going adrift, namely, getting beached in one of the unfortunate lands:

- The land of the ivory tower: overly abstract and overly strategic orientation, insufficient feedback from operative projects
- The land of the condescending smile: operative orientation, but without sufficient detail – the architect is not taken seriously by those involved in projects
- The land of the ants: continuous updating and maintenance of the enterprise architecture at an excessive level of detail generate staggering expenses
9 Conclusion: Finding the Right Course

- The land of the beautiful: many details, little knowledge of and feedback from operative events

Figure 9-3: Finding the Right Course

How do we prevent ourselves from drifting away, how are we to navigate our EA program? We can find the right orientation by rowing on both sides, on the strategic side and the operative side. We define compliance rules for our own IT strategy:

- Where is our IT strategy reflected in our EA? Which elements indicate compliance with the IT strategy?
- How do we follow through on our IT strategy? What deployment scenarios, reference architecture models, rules for the architecture board and operative architects are available that join implementation to strategy?
• Where does the impact of the decisions reached in the governance board turn up in the EA?

We can find the right level of abstraction by beginning with our IT strategy and our IT governance goals:
• What information and control parameters are necessary?
• What analyses are necessary in order to obtain this control information?
• What elements, attributes, and relationships are necessary in the EA model to carry out these analyses?

We thus start in the middle, from the control parameters and analyses. The EA is always established with the level of detail that is necessary to enable one carry out the analyses that are necessary for control: not less detailed (for then we will not be able to navigate owing to a lack of information), and not more detailed (for then elements, relationships, and attributes of the enterprise architecture will remain unused).

The above-mentioned aids will enable us to orient ourselves and ascertain the right level of abstraction for establishing EA and architecture management, focused on the needs and goals of the IT management.
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Figures

Figure 2-1: EA Urgency Zone .................................................................15
Figure 2-2: The EA Pyramid .................................................................17
Figure 2-3: Architecture Management ................................................23
Figure 2-4: Operative and Strategic Architecture Management .......23
Figure 2-5: Initial Distribution of IT Costs .......................................30
Figure 2-6: Resources Allocated for Innovation as a Percentage of Overall IT Budget (PFE2003) .........................................................31
Figure 2-7: IT Cost Distribution after Budget Cut ............................32
Figure 2-8: Declining Innovative Capacity ........................................33
Figure 2-9: IT Cost Distribution after Optimization ........................34
Figure 2-10: The EA Cycle .................................................................37
Figure 2-11: IT Strategy Framework ..................................................38
Figure 2-12: IT Management Processes ...........................................40
Figure 2-13: EA Development ...........................................................41
Figure 3-1: The Goals of Architecture Management .......................46
Figure 3-2: EA Utility .................................................................47
Figure 3-3: Applications Environment Complexity .........................54
Figure 3-4: Homogenization ............................................................56
Figure 3-5: Project Portfolio .............................................................59
Figure 3-6: Measures Catalogue for Software Architecture ..........69
Figure 3-7: Reduction in Project Set-up Times .................................70
Figure 4-1: A Basic EA Model ..........................................................77
Figure 4-2: Software Architecture ......................................................78
Figure 4-3: Visualizing Points of Impact and Dependencies in EA 80
Figure 4-4: Requirements Management and Applications Environment .................................................................81
Figure 4-5: Business Processes in the EA ........................................82
Figure 4-6: Project-specific EA View ............................................84
Figure 4-7: Stakeholder-specific EA Views ....................................84
Figure 4-8: EA: The Big Picture ..................................................84
Figure 4-9: Business Processes and Business Components .............89
Figure 4-10: Business Architecture Metamodel (Level B) .............93
Figure 4-11: Deployment Scenarios and Systems .........................98
Figure 4-12: Deployment Scenarios and Reference Architecture Models .................................................................99
Figure 4-13: Consolidation of Development Lines .......................100
Figure 4-14: Overview of a Software Architecture Metamodel (Level B) .........................................................................106
Figure 4-15: Structure of the Set of Infrastructure Standards .........109
Figure 4-16: Embedded Application Systems ...............................110
Figure 4-17: Structure of Development Environments ................111
Figure 4-18 Support Level Definition ...........................................113
Figure 4-19: System Architecture Metamodel (Level B) .............116
Figure 4-20: Applications Map for an Insurance Company .........117
Figure 4-21: Representation of an Applications Map in an Architecture Management Tool (ACT2005) ................119
Figure 4-22: Product-Process Application Systems .....................120
Figure 5-1: Dependency Analysis (ACT2005) ..............................129
Figure 5-2: Coverage Analysis of Redundancies .........................130
Figure 5-3: Coverage Analysis of Gaps .......................................131
Figure 5-4: Interface Analysis ....................................................132
Figure 5-5: Heterogeneity Analysis of the Development Lines ....136
Figure 5-6: Set of Infrastructure Standards (ACT2005) ..............137
Figure 5-7: Compliance with the Defined Reference Architecture Models ..........................................................................141
Figure 5-8: Cost Model .................................................................143
Figure 5-9: Annual Costs per Application System .......................143
Figure 5-10: Cost Analysis ..........................................................144
Figure 7-15: Architecture Management Tools .........................194
Figure 8-1: Not Invented Here ........................................201
Figure 8-2: Specification Form for Architectural Drafts ..........205
Figure 8-3: COBIT® Processes .......................................206
Figure 8-4: Architecture Management Scorecard ..................208
Figure 8-5: Architecture Management Scorecard Showing KPIs 209
Figure 9-1: From Enterprise Architecture to IT Governance ....213
Figure 9-2: The Right Orientation and Degree of Abstraction ...215
Figure 9-3: Finding the Right Course ................................216
## Index

Coverage ........................................129  
Dependency ....................................129  
Dependencies .................................126  
Alignment ....................................10, 197  
Abstraction .................................82, 86, 214  
Degree of abstraction ......................15  
Agility .........................................10, 91, 198, 211  
Up to date ...................................8, 157  
Acceptance ....................................197  
Analysis .....................................37, 124  
Analysis procedures ........................126  
Requirement ...................................102  
Requirements ...................................80  
Requirements management ..............9, 174  
ANSI/IEEE Standard 1471 ..............21  
Applications architecture ...............17, 85, 94  
Applications map ............................117  
Applications environment ...............7, 18, 64, 77, 85, 116, 125, 153, 170  
Architecture ..................................17  
Architecture board .........................101  
Architecture domains ......................95  
Architectural draft .........................102, 204  
Architecture management ...............5, 9, 22, 168  
Operative ....................................172  
Strategic ....................................170  
Architecture management .............169  
Architecture management process .......177  
Architecture management scorecard ....207  
Architecture relevance ....................204  
Asset ...........................................64  
Organizational structure ..................178  
Training ......................................182  
Excerpt ......................................82, 86, 159  
Balanced scorecard .......................124, 126  
Blueürint ..................................18  
Development plan ...........................161  
Development planning .................8, 9, 153, 155, 160  
Participation ................................10, 197  
Operating costs ..............................5  
Board .........................................203  
CIO ........................................3, 15, 31, 204, 205, 207  
City planning ...............................17  
Clinger-Cohen Act .........................71  
COBIT .......................................206  
COBIT® ....................................10  
Compliance rules .........................139, 203  
Corporate governance ...................26  
Critical success factor .................206  
Diffusion ....................................207  
Documentation ...............................37  
Implementation of the EA process .......207  
Effectivity .................................28, 57, 64, 201  
Efficiency .....................................28  
EFQM .......................................147  
Deployment scenario ........................6, 95, 204  
Savings ......................................48  
Development lineS .........................97, 98, 101, 154  
Empirical data .............................97  
Success factor .............................10, 197  
Results orientation .......................10, 198  
Business development planning .......156  
Business project ..........................101  
Feedback .....................................205  
Firmitas ..................................196  

Index

Framework..................................................189
Gap analysis..................................................124, 166
Business architecture........................................17, 76, 85, 87
Business components.................................88
Business process..........................................1, 88
Business process models...............................16
Governance..................................................V, 1, 26, 96, 201
Governance board.........................................10, 203
GPS..............................................................36
Boards......................................................10, 203
Major project..............................................51, 159
Period of validity.........................................158
Field of action..............................................14
Heterogeneity..............................................49, 55, 95, 133, 134, 153
Heuristics...................................................66
Historicizing...............................................86, 157, 158
Homogenization..........................................55
Housekeeping..............................................5, 60
Infrastructure..............................................107
Infrastructure landscape..............................5, 107, 153
Infrastructure management..........................112
Innovation..................................................31
Innovative strength.......................................32
Innovation potential......................................V, 1
Stakeholder...............................................83
Stakeholders...............................................86
Inventory....................................................114
IT governance..............................................28, 196
IT architect...............................................1, 24
IT architecture.............................................21
IT architect’s office.......................................1
IT development............................................186
IT governance..............................................4, 7, 29, 38, 75, 126, 138, 167
IT governance process.................................45
IT management..........................................178
IT management process...............................161
IT management..........................................75
IT strategy..................................................198
Key figure.................................................205, 207
Key goal indicator......................................206
Key performance indicator.............................195, 203, 206
Coexistence.................................................155
Communication............................................197
Complexity.................................................51, 54, 138, 153
Applications environment
complexity....................................................138
Conformity.................................................140, 203
Consistency..................................................49
Consolidation..............................................5, 51, 54
Control......................................................37
Costs.........................................................43, 153
KPI............................................................157
Map............................................................153
Life cycle....................................................5
License management.....................................114
Low hanging fruits......................................200
Magic quadrant............................................151
Management support.................................202
Promotion...................................................10, 198
Statistical parameter..................................203
McCabe Metric..........................................138
Quantity structure......................................125
Mentor.......................................................202
Merger.......................................................51, 160
Measureability..........................................10, 197, 198, 202
Measuring procedures.................................10, 202, 203, 205
Metamodel................................................92, 115
Metis®.......................................................136
Migration....................................................155
Monitoring..................................................206
Network documentation..............................114
Network topology........................................113
Benefits.....................................................43, 45, 50, 211
Utility potential..........................................151
Optimization..............................................49
Organizational diagram...............................13
Organization...............................................177, 178
Orientation.................................................214
Outsourcing...............................................51
Performance indicator...............................202
<table>
<thead>
<tr>
<th>Certification</th>
<th>183</th>
</tr>
</thead>
<tbody>
<tr>
<td>Future scenarios</td>
<td>157</td>
</tr>
<tr>
<td>Target support</td>
<td>151</td>
</tr>
<tr>
<td>Purpose</td>
<td>25</td>
</tr>
</tbody>
</table>