Structured e-Business

from business models
to information technology
with the BOAT framework

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Preface

This document has been written as a framework reader for the Electronic Business Architectures and Systems (EBAS) course taught at the School of Industrial Engineering at Eindhoven University of Technology (TU/e, Netherlands). In its 2008 version, this reader is also in use at the Department of Supply Chain & Information Systems of Pennsylvania State University (PSU, USA) and at the Economics and Management School of Beijing University of Technology (BJUT, China).

The document is a framework reader as it provides a general framework on the topic of electronic business in which many topics are discussed with their interrelationships – ranging from business to information technology aspects. As such, the individual topics are not treated at the most possible depth – the aim is to provide a complete and cohesive overview of the domain. The reader is expected to find more detailed material him/herself based on the framework offered (the reference list at the end of this document provides a first point of entry to the literature).

Samuil Angelov is thanked for his feedback on the draft versions of this document and the collaboration in presenting the material to students at TU/e. Akhil Kumar of PSU is thanked for his suggestions with respect to extensions of the material covered in this reader.

The reader is wished a good deal of reading pleasure into the dynamic domain of electronic business.

Paul Grefen

Eindhoven, 2006-2009

Version History

2006: The first version of this document is published and used in the 2006/2007 EBAS course at TU/e.

2007: The document is heavily extended with respect to the 2006 version. It contains explicit attention to mappings between all pairs of the BOAT aspect cycle. The notion of *dependency diagram* has been added to strengthen this element. The discussion of the technology (T) aspect is extended with sections on Internet technology, multi-agent systems and hybrid platforms. Many small additions and improvements have been made all through the document.

2008: The introduction has been reorganized and a brief discussion of the history of e-business has been added. The BOAT framework has been related to strategic business-IT alignment. The business (B) aspect chapter now includes an extended discussion of *reach & richness* and a discussion of ordering the business aspect elements. More details have been added to the T aspect chapter. And again, small additions and improvements have been made at many places.

2009: The title of the document has been changed. The text has been elaborated at many places to provide better explanations and more examples.

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1 INTRODUCTION

Electronic business (or e-business for short) is all around us nowadays. Although the extreme e-business hype (or Internet Bubble [Per99]) has passed, it is clear that the combination of computers and business has a high impact on how modern economy (and the entire society, for that matter) operates [Pie01]. But when one takes a look around, the question "what exactly is e-business?" quickly comes to mind. Clearly, not any combination of computers and business constitutes e-business – if this were the case, we would have had e-business back in the sixties of the previous century when business organizations started using computers.

In the first section below, we deal with the question what e-business is and try to provide some clarity here. Next, we briefly discuss the history of e-business. In the third section, we compare the term e-business to a number of related terms. Then, we take a closer look at the relation between business and technology in the e-business context. In the last section of this introduction, we explain the purpose and structure of our exploration and hence the structure of this reader.

1.1 What exactly is e-business?

As we have stated above, e-business is not just any combination of computers and business. A company that only uses a computer to perform its salary administration does clearly not constitute e-business. To start, we must observe that we don't use the term e-business to denote an organization form or information technology, but a set of business activities performed by one or more organizations. Below, we first work towards a basic definition that distinguishes e-business from non-e-business. Next, we extend this definition to identify the interesting subset of e-business, which we address in the sequel of this document.

Towards a basic definition

To call a combination of business activities and information technology *e-business*, a number of criteria have to be met:

1. The activities must be *core activities* (also called primary activities) for the business, i.e., they must be directly related to the reason of existence of the involved organization(s). For example: for an airline company, selling tickets and transporting people are core activities, but bookkeeping and cleaning their offices is not.
2. The use of information technology must be essential for the way the activities are performed, i.e., the activities are *IT-enabled*. Activities for which efficiency or effectiveness are only improved by the use of IT are called IT-supported activities – hence, they do not qualify for e-business.
3. The information technology must be used in an *integrated fashion* for both processing and communication of information. If only one of these two aspects is enabled by IT, we do not call it e-business.

The above criteria lead to the following basic definition of e-business that we use in this document:

> *Electronic business is conducting core business activities in a way that is enabled by the integrated use of information technology for processing and communication of information.*

If you prefer ultra-short definitions, you might use the following abbreviation:

> *E-business is IT-enabled business*.

Towards an extended definition

The above definition separates e-business from non-e-business by stating the minimum requirements that have to be met. Using minimum requirements implies including quite a lot, also the not-so-interesting cases. To distinguish the not-so-interesting from the o-so-interesting cases, we have to discuss two aspects: scope of activities and dynamism of relations.

The *scope of activities* determines whether activities are executed entirely within the boundaries of a single organizational (intra-organizational) or are executed across the boundaries of organizations (inter- or cross-organizational). If activities are inter-organizational, they are part of collaboration between organizations. Inter-organizational e-business helps in transforming the nature of collaboration in business markets. Usually, inter-organizational e-business has further-reaching consequences than intra-organizational e-business, making it more complex but also more interesting.

The *dynamism of relations* determines how dynamic the relations are between organizations that together engage in e-business activities. E-business can help in decoupling dependencies between organizations because it enables new forms of collaborations, thereby enabling highly dynamic partnerships. Dynamism of relations is obviously only of interest to inter-organizational e-business. Highly dynamic partnerships are clearly more interesting than static partnerships, as they have to rely to a larger extent on specific characteristics of e-business.

Given the above discussion, we provide an extended version of the basic definition of e-business given above, which delineates the *interesting* field of e-business:

> *Electronic business is conducting inter-organizational core business activities in dynamic collaborations, such that these activities are enabled by the integrated use of information technology for both communication and processing of information.*

In this document, we concentrate on e-business conforming to this definition. We start the discussion below with a brief discussion of the history of e-business.

1.2 A brief history of e-business

Although e-business is not per se coupled to the use of the Internet (as we have seen in the definitions of the previous section), its development is closely related to that of the Internet. Before the rise of the Internet, e-business relied on dedicated digital communication channels, i.e., communication channels that were created for specific business activities between specific pairs of business partners. With these, standards like Elec-

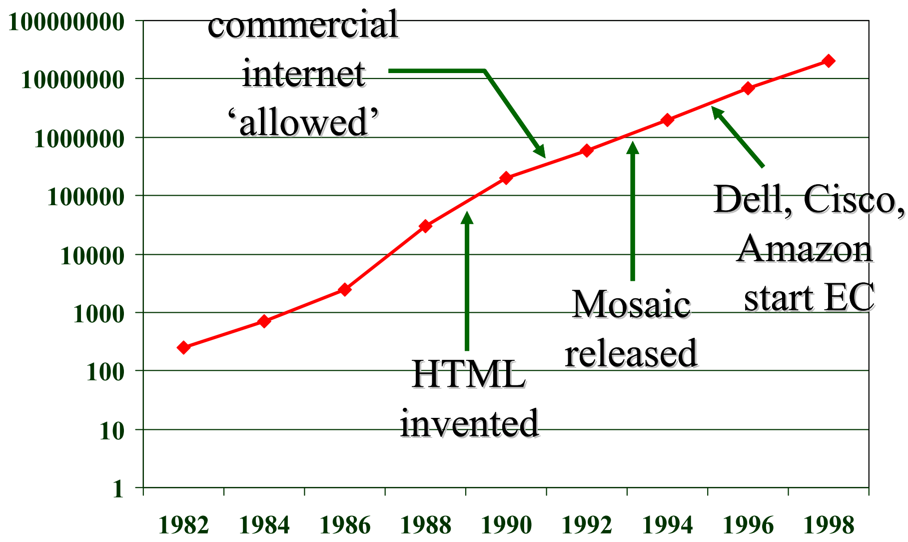

Figure 1: overview of Internet and -business developments

tronic Data Interchange (EDI) [Sok95] and Electronic Funds Transfer (EFT) [Kir87] were supported to allow business organizations to electronically support business transactions. These channels were usually very expensive and time-consuming to set up (and maintain) and therefore typically supported static business collaborations between two large organizations.

With the advent of the Internet, a ubiquitous and cheap infrastructure became available for business transactions. We show the development of the Internet and the early development of e-business together in Figure 1. In this figure, the vertical axis on the left shows the number of Internet hosts, i.e., the number of computers connected to the Internet. Note that the vertical axis has a logarithmic scale: the figure shows that the Internet has undergone an exponential growth since the early eighties of the previous century. It is this growth that has enabled the pervasiveness of both Internet computing and of e-business. Currently, the Internet is 'always everywhere' – making 'ubiquitous' rather literally true[1].

The figure shows two technology milestones: the definition of HTML as the Web markup language and Mosaic [Rau95] as the first publicly released Web browser. Together, these two milestones enabled the World Wide Web or WWW, one of the technology cornerstones of e-business. The figure also shows that commercial use of the Internet was only allowed from the early nineties of the previous century. Among the first large commercial parties taking advantage of the Internet possibilities were Dell [Del06], Cisco [Pau01] and Amazon [Mar05]. The fact that two of these three are IT companies is not a coincidence, as using e-business was still highly technology-dominated in those days.

Towards the turn of the century, e-business (then often labeled 'e-commerce') got into a hype of tremendous (if not ridiculous) proportions. Many were convinced that prefixing

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[1] Ideas exist to even extend the Internet to the planet Mars (see e.g. http://www.itwire.com/content/view/9802/1066/), although the use of that for e-business purposes can be questioned, obviously.

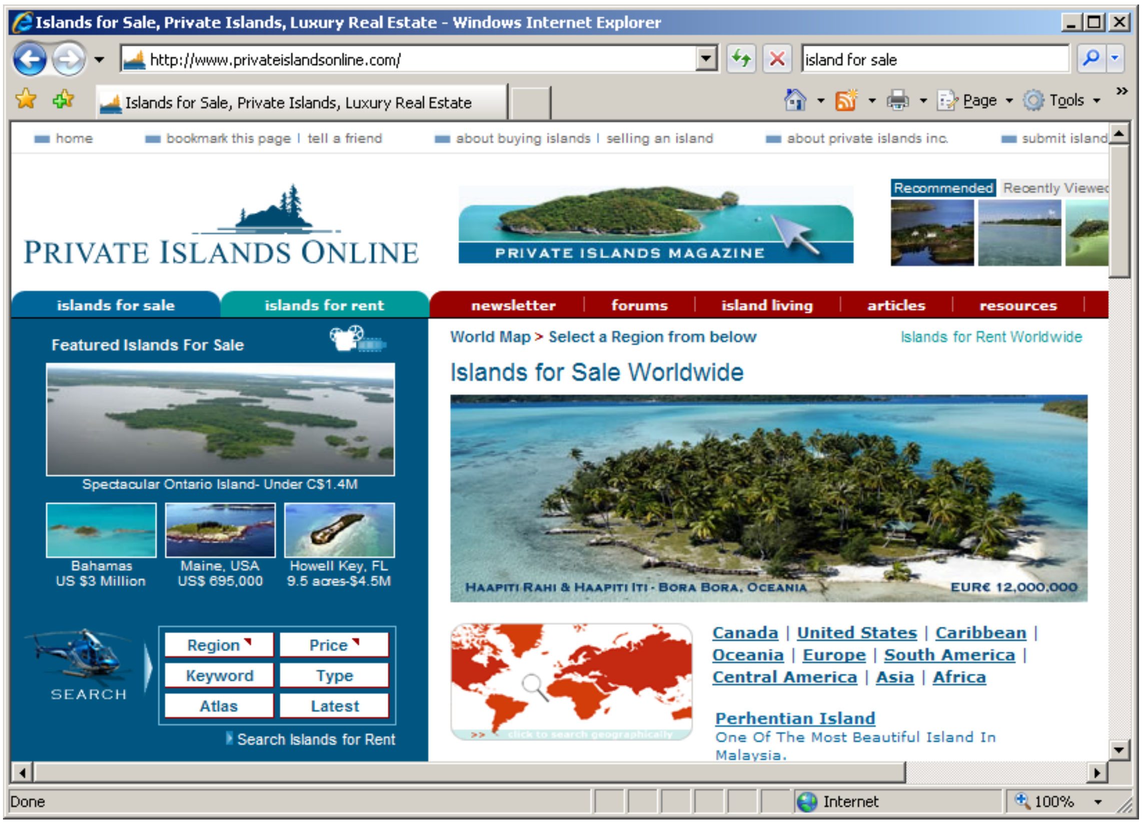

Figure 2: (almost) anything can be traded using e-business ...

any business idea with an ‘e’ would lead to immediate success (and of course wealth of the inventor). The number of e-business companies grew at an exponential rate too, not unlike the Internet that provided the technical infrastructure for them.

The hype lasted for a few years only though, until people realized that not all that shines (or appears to shine) is gold. Many Internet startups went bankrupt after only short operating periods. Or as a coined phrase: the Internet bubble burst. Many were disillusioned, thinking that the days of e-business were over. But this wasn’t the case at all: digital castles in the air were separated from realistic e-business developments.

After the burst of the Internet bubble, e-business has been growing steadily and has taken a solid position in the global economy. In many domains, e-business has become the primary way of doing business, like in the banking and insurance industry and the travel industry. Other domains are currently in a transition phase, like the music and publishing industries. Anything can be traded using e-business, from simple pencils to complete islands (see Figure 2). It is this mature version of e-business that we deal with in this reader.

1.3 E-business, e-commerce and other terms

The term e-business is used (and misused) in many different ways. Here, we try to place it in the context of a number of related terms.

A term that is often used as a synonym of e-business is *e-commerce*. We, however, see e-commerce as a subset of e-business, i.e., all e-commerce is e-business but not the

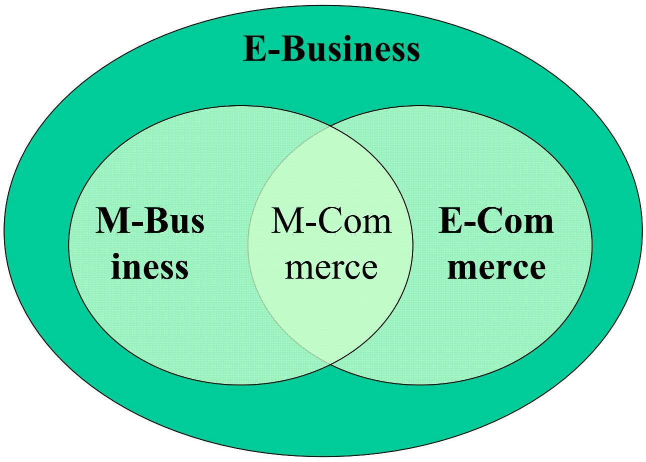

Figure 3: relation between some terms

other way around. In our use of the word, the term e-commerce implies the explicit trading of objects (physical or non-physical, see Section 2.3). E-business may include trading, but doesn't have to: collaborative design through electronic channels is an example of e-business in which there is no explicit trading (one may argue, however, that there is implicit trading as parts of designs are exchanged between organizations). Note that other visions on the relation between the terms e-business and e-commerce exist in literature: for example the vision that e-business refers to intra-organizational activities and e-commerce to inter-organizational activities [VaH03].

The term e-business does not imply anything about the nature of the digital communication channel to communicate. If we restrict the channel to wireless channels, we move from electronic business to *mobile business* or *m-business*. As such, m-business is a subset of e-business. If m-business is about explicit trading, we speak of *m-commerce*.

The subset relations between e-business, m-business, e-commerce and m-commerce are shown in Figure 3.

Apart from the terms introduced above, many other related terms have been invented, like *internet commerce* or *i-commerce*, *digital commerce*, *cyber commerce* and *cyber business*, *virtual commerce*, *online commerce* and *online business*, etcetera. To make things worse, these terms are used differently in different places. Hence, we don't try to discuss them all.

1.4 Business versus technology

In the developments in the e-business field, business and technology aspects are very much interwoven. In many other fields, business developments create new requirements on technology. In other words: technology follows business. In the field of e-business, however, many business developments have taken place because the enabling technology created the opportunity. A well-known and very clear example is the development of the use of the Web for B2C applications: the Web was not developed because business has demanded this, but the mere existence of the Web has pushed business into new directions.

So, the developments in e-business are driven by two concurrently operating forces that reinforce each other: a market pull (also called requirements pull) and a technology push (see Figure 4). Both forces are strong in the sense that they are driven by rapid developments (which is very easily observable for the technology side[2]), thus causing e-business to change at a rate that is something hard to keep up with. In trying to understand developments, we must always be aware of this force field.

Figure 4: technology push and requirements pull

1.5 Goal and structure of this reader

Now we have a first impression of the domain of e-business, it is time to see what and how this reader contributes to our further understanding. To do so, we discuss goal and structure of this reader below.

Goal of this reader

The goal of this reader is to explain the domain of e-business in a well-structured way covering the complete spectrum from business to technology aspects. Note that many explorations of the domain do already exist, but in isolation most are not fit for our purposes. Often, they have a rather narrow main focus, e.g. mainly on business aspects [Phi03, McK04], sometimes explicitly with a case-based orientation [Ell02], or mainly on technology aspects [VaS03]. Often, they do not follow a well-defined structure that indeed helps in clearly and unambiguously charting the e-business territory. To achieve clear structure, we introduce a multi-dimensional analysis space and a four-aspect framework in the sequel of this reader.

Note that the purpose of this document it to provide a more or less time-independent framework for the e-business domain, not so much lots of volatile technical details or case studies – for this, the reader is referred to the heaps of related material.

Structure of this reader

In this chapter, we have given a first introduction of the field of e-business. In the next chapters, we explore this field in a systematic way. We start with identifying a number of dimensions for analysis of the field in Chapter 2. From these dimensions, we choose one as leading dimension for the structure of this document (as a text is in principle one-dimensional). To explore this dimension, we discuss the BOAT framework in Chapter 3. The BOAT framework distinguishes between four aspects of e-business (one for each letter in the acronym): business, organization, architecture and technology. These aspects are each discussed in more details in Chapters 4 to 7. As BOAT is about relating

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[2] Information and communication technologies come and sometimes go at rapid rates. Development and acceptance of new technologies is very nicely illustrated by the *hype cycle* model developed by Gartner [Fen05].

aspects, we pay explicit attention to mapping the discussed aspects to the other aspects in Chapters 5 to 7. In Chapter 8, we give some hints about how to use the BOAT framework as an analysis instrument for the assessment of e-business applications. Chapter 9 concludes this reader by presenting some final observations.

2 A MULTI-DIMENSIONAL SPACE

When we want to explore the e-business domain in a well-structured way, we need an instrument to clearly organize the relevant aspects of e-business, or in other words, to be able to clearly classify specific e-business scenarios. In this chapter, we introduce a multi-dimensional space of e-business characteristics that is such an instrument. In the first section below, we describe the structure of the multi-dimensional space. In the next two sections, we go into some details of two of the dimensions identified in the space. The most important dimension (as we use it to further structure our exploration) is elaborated in more detail in Chapter 3.

2.1 Structure of the analysis space

When exploring a complex field of e-business, it is important to distinguish various dimensions in which an e-business scenario can be described. Having multiple dimensions allows us to use a clear separation of concerns in analyzing (or designing) an e-business scenario.

The analysis space used in this document consists of three orthogonal[3] dimensions (see Figure 5, in which the dimensions are portrayed as a 3D space):

Parties in e-business: this dimension contains the possible options for the parties that perform the e-business activities. This dimension is further elaborated in Section 2.2

Objects of e-business: this dimension contains the possible options for the type of object that is primarily manipulated by e-business activities. We further discuss this dimension in Section 2.3.

Aspects of e-business: the aspect dimension is used to choose which aspect level of an e-business scenario we want to analyze or describe. We use the BOAT framework for the aspect dimension, which we treat in detail in Chapter 3.

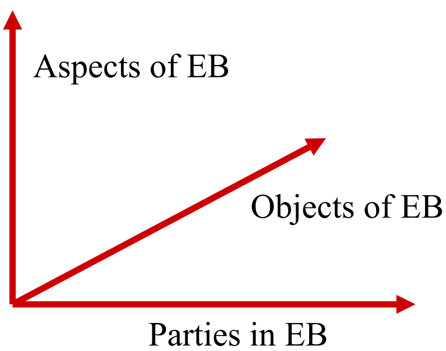

Figure 5: multi-dimensional analysis space

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[3] By 'orthogonal' we mean that values in different dimensions are independent from each other, i.e., a specific choice in one dimension does not influence possible choices in the other dimensions. Compare Figure 5 to a set of axes in geometry, in which x-, y- and z-values can be chosen independently.

Clearly, other dimensions can be added to the three above, e.g. a 'time' dimension, in which we can classify the duration of the life cycle of an e-business activity. For reasons of clarity and brevity, however, we limit ourselves to three dimensions in this document. The *parties* and *objects* dimensions are discussed in the following sections. The *aspects* dimension is treated in the next chapter.

2.2 Parties in e-business

In the previous section, we have seen the three dimensions that are the basis for the e-business analysis space. In this section, we elaborate the *parties* dimension by analyzing which combinations of parties can engage in e-business relationships.

In general, the following three types of party can be involved in an e-business collaboration:

Business party: a commercial organization of any size and any type, ranging from a multi-national to a one-person company.

Consumer party: an individual acting as a private person (note that this is different from an individual acting on behalf of a business).

Government party: (a part of) a government organization (such as the tax office) or a related non-profit organization (such as a public educational organization).

If we combine the three types of party in all possible ways, we get the combinations shown in Table 1. In this table, the vertical dimension indicates the *initiator* of an e-business activity, i.e., the party that starts the activity. The horizontal dimension indicates the *responder*, i.e., the party that responds to the initiative by participating in the activity.

Initiator ↓	Business	Consumer	Government
Business	**B2B**	**B2C**	*B2G*
Consumer	*C2B*	C2C	*C2G*
Government	G2B	**G2C**	*G2G*

Table 1: overview types of e-business

The most used combinations in the table are printed in bold. Certainly the combinations B2B and B2C are coined terms in the e-business world. G2C gets quite a bit of attention in specific circles too (often termed *e-government*). Typical G2C examples are electronic tax handling and the use of electronic portals through which municipalities serve their citizens in various ways.

G2B and C2C scenarios are less common, but there are practical applications in these classes. Typical examples for the C2C class are electronic markets at which individuals sell or barter[4] (second-hand) goods. We have G2B e-business if government bodies in-

[4] Bartering through electronic markets seemed like a way to avoid the tax system (as no money is transfered). But nowadays, tax offices have regulations for this – see e.g. the regulations about Barter Exchanges on www.irs.gov.

teract with business organizations through electronic channels, e.g. for handling of business taxes.

The four least important combinations are printed in italic gray in Table 1. But also of these, examples can also be found.

Concluding, we find 9 combinations of parties that form the values along the *parties* dimension of the e-business analysis space.

Note that we do not include intermediaries as parties here, although they can be very important for the implementation of e-business processes. Typical intermediaries are search engine and catalogue providers, payment service providers and transport service providers. In principle, intermediaries can also be of business, consumer or government type. One e-business scenario may include multiple intermediaries, however, for various intermediary roles (payment handler, goods transporter, etcetera). Therefore, including intermediaries in the dimension would make this dimension overly complex.

2.3 Objects of e-business

In this section, we elaborate the *objects* dimension of the e-business analysis space (see Figure 5).

As we have seen before, the type of objects that is manipulated (for example traded) in e-business is important to characterize an e-business setting. We distinguish between the following basic classes and subclasses of e-business objects:

- *physical goods* are tangible goods which are physically exchanged between e-business parties; subclasses are:
  - *discrete merchandise*: goods that are exchanged on a per piece basis, e.g. books, music CD's, office furniture.
  - *bulk goods*: goods that are exchanged on a per volume basis, e.g. crude oil.
- *digital goods* are intangible goods which are electronically exchanged between e-business parties; subclasses are:
  - *digital content*: copies of published and catalogued (multi-media) content[5], e.g. e-books, digital music (usually in MP3 format), on-demand movies.
  - *digital information*: on-demand produced informational data, e.g. electronic weather forecasts, on-demand stock analyses.
- *services* are activities that one party in an e-business relation performs for another party, taking relevant characteristics of this other party into account; subclasses are:
  - *physical services*: activities that involve manipulation of physical objects that are not exchanged goods, e.g., air transportation, car washing.

[5] Note that digital goods are replacing physical goods that are information carriers, e.g. online music in MP3 format from commercial music sites is replacing physical CD's containing the same music.

    - *non-physical services*: activities that do not involve manipulation of physical objects, often of an advisory kind, e.g. stock portfolio management, personal shopping advice, agenda management.
- *hybrid objects* are combinations of the above, e.g. a physical device with a maintenance contract.

The boundaries between the above classes are not always 100% clear. For example, one might argue that a music CD is a hybrid object consisting of a physical information carrier and digital content. The line between digital information and non-physical services is sometimes hard to establish. An example of an e-business object that fits into two classes is a personalized holiday weather information service. These examples are illustrations of the fact that e-business can erase boundaries that used to be clear – and proper classification thus becomes even more important to keep things as much as possible in the clear.

3 THE BOAT FRAMEWORK

In the previous chapter, we have introduced a three-dimensional space for the analysis of e-business scenarios. Of this space, two dimensions (parties and objects) have been explored. In this chapter, we investigate the third dimension: that of aspects of e-business. In Section 3.1, we describe the four aspects that we find along this dimension, making up the BOAT framework. In Section 3.2, we discuss how we can place the BOAT aspects with respect to each other. In the sequel of this document, Chapters 4 to 7 discuss more details of each of the four aspects.

3.1 Aspects of e-business

The aspects dimension of e-business is the dimension that covers the spectrum from very business-oriented to very technology-oriented. In this spectrum, we distinguish four aspects that together form the BOAT framework:

Business (B): the business aspect describes the business goals of e-business. As such it answers the question *why* a specific e-business scenario exists or should exist or *what* should be reached. Topics can be leverage of efficiency levels, access to new markets, reorientation of interaction with customers, etcetera. *How* things are done is not of interest in this aspect. The B aspect is treated in more detail in Chapter 4.

Organization (O): the organization aspect describes *how* organizations are structured to achieve the goals defined in the B aspect. Organization structures and business processes are main ingredients here – automated systems are not yet in scope in this aspect. The O aspect is further elaborated in Chapter 5.

Architecture (A): the architecture aspect covers the conceptual structure (architecture) of automated information systems required to make the organizations defined in the O aspect work. As such, it describes *how* automated systems support the involved organizations. The A aspect is discussed in Chapter 6.

Technology (T): the technology aspect describes the technological realization of the systems of which the architecture is specified in the A aspect. The T aspect covers the concrete ingredients from information and communication technology, including hardware, software, languages and protocols. It is further treated in Chapter 7.

Before we go further, we need to add a small explanation. The term *architecture* in general relates to *structure* of arbitrary things. As such, it is in principle applicable to all four BOAT aspects. One may, for example, speak about *business architecture*. In the BOAT framework, the A level is dedicated to the structure of automated e-business systems, however. As such, it coincides with *information system architecture*[6].

3.2 Stack or wheel model?

In the previous section, we have introduced the four aspects of the BOAT dimension, which reach from the business side to the technology side. In traditional information

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[6] So BOAT might have been called BOIT, but that does not sound as nice ...

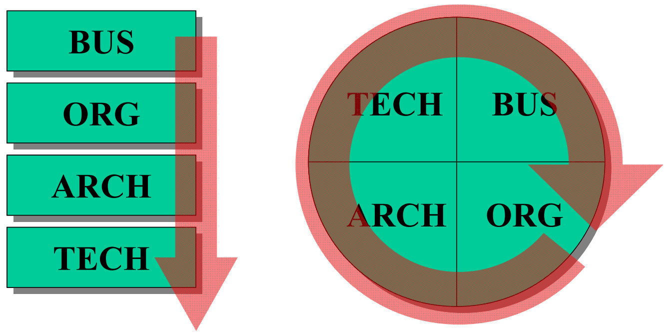

Figure 6: BOAT - stack or wheel?

system design practice, analysis and development of systems proceeds in a linear way from the business to the technology side (also referred to as the waterfall *model* of system design). In the BOAT dimension, this would mean starting from the B aspect and working stepwise to the T aspect, where each preceding aspect defines the requirements that must be fulfilled in the succeeding aspect[7]. This leads to a design process as depicted in the left hand side of Figure 6, which we call the *stack model* for BOAT.

But in the e-business field, the relation between business and technology is not so linear. As we have seen before, business 'pulls' technology development by stating new requirements, but technology also 'pushes' business by offering new opportunities. To model this, we need to organize the BOAT aspects such, that we get a more cyclical dependency between the aspects. This results in the picture as shown in the right hand side of Figure 6, which we call the *wheel model* for BOAT. With the wheel model, we can make two important observations:

1. A development process can – in principle – start at each aspect of the model (although B and T aspects may be most common). A new organization structure in the O aspect, for example, may be the trigger for a new e-business scenario.
2. The wheel model suggests a cyclical process: an e-business development process does not end after one cycle around the wheel, but is rather a continuous process of adjustment to new business and technology contexts.

3.3 BOAT and strategic alignment

The BOAT framework can be related to strategic alignment models that model the interplay between strategic design of business and use of information technology.

Probably the best known alignment model is that of Henderson and Venkatraman [Hen93] (shown in Figure 7 in simplified form). It shows the interplay between the strategy and operational aspects (vertical dimension) and the organizational and information technology aspects (horizontal dimension) by focusing on the four relations (indicated by the arrows).

[7] Note that *aspects* in this linear approach are effectively *levels*.

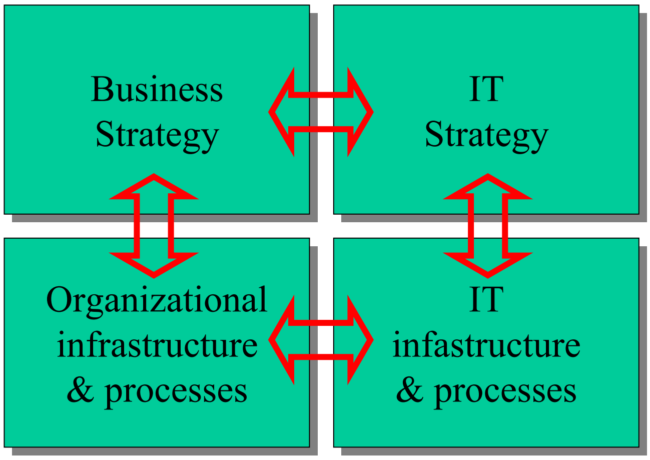

Figure 7: strategic alignment model

There is a similarity between the quadrants in this model and the BOAT framework:

- BOAT B aspect → Business strategy
- BOAT O aspect → Organizational infrastructure & processes
- BOAT A aspect → IT strategy
- BOAT T aspect → IT infrastructure & processes

The similarity is not a clear mapping though, as the BOAT model is more about structure than about strategy. Certainly the A aspect of BOAT is intended to describe structures of automated information systems, not so much the strategy to get to structures.

4 BUSINESS ASPECT

In this chapter, we briefly explore important elements of the business aspect of the BOAT dimension. Business topics are discussed in more detail in other publications [Eva99, Per99, Pie01, Tur02, VaH03, Jel05]. Below, we first take a look at main business characteristics that are redefined through the use of e-business. Then, we see how e-business can restructure business collaborations. Based on this, we identify a number of new business dimensions. These new dimensions enable new business forms, which we discuss in the last section of this chapter.

4.1 Redefining business characteristics

Business is e-business if it is different from other types of business through the essential use of electronic information and communication technology. There are two important aspects in which e-business can be different from traditional business: *reach* and *richness* [Eva99]. Below, we first discuss them individually, then combine them. After that, we spend a few words on the efficiency characteristic.

Reach

The reach of an e-business scenario defines which business partners can be included in that scenario. The aim of the use of information and communication technology is to increase the reach of a scenario.

We distinguish between three types of reach:

Geographic reach determines where potential partners are geographically physically located. Increasing geographic reach means attracting partners that are further away.

Temporal reach determines during what times potential partners can be active in a scenario. Increasing temporal reach means opening up business more hours a day and/or more days a week (ultimately going to *24x7*).

Modal reach determines through what channels business partners can collaborate, i.e., what communication means can be used between partners. Increasing modal reach means opening new channels.

Obviously, in a specific e-business scenario, the aim can be to address more than one type of reach. Note that increase of geographic reach on a large scale may imply the necessity of increase of temporal reach – this to deal with time zone differences around the globe.

Richness

The richness of an e-business scenario is determined by the intensity of the communication between collaborating partners. Richness has a number of sub-aspects:

Frequency of communication determines how often partners have contact. In traditional business scenarios, frequency may be low because of cost or lack of speed of used channels. In e-business, more frequent communication can often easily be established.

Level of detail in communication determines how many details about manipulated objects or the manipulating processes are communicated between partners.

Used media in communication determine which media types (text, graphics, photos, animations, audio, and video) are used in communication. In e-business, a richer medium selection can be used than in traditional business.

Level of interactivity in communication determines how much interaction there is in communication. Where traditional paper-based communication allows very little interaction, web-based communication allows much more.

Adaptation to partner determines how much the communication is adapted towards specific business partners. In B2C scenarios, the term *personalization* is commonly used here, but the concept applies to B2B scenarios as well.

Note that *modal reach* and *used media* have a strong connection: the available communication means heavily determine what media types can be used. Though connected, they are different things: *modal reach* is about communication infrastructure, whereas *used media* is about communication content.

Increasing reach and richness

Designing new e-business scenarios is often based on increasing reach, increasing richness, of increasing both. Put into other words: an e-business transformation often implies moving a business scenario further into the reach and/or richness dimensions. This is illustrated in Figure 8: here the arrow indicates an example increase in reach and richness from a traditional business scenario to an e-business scenario.

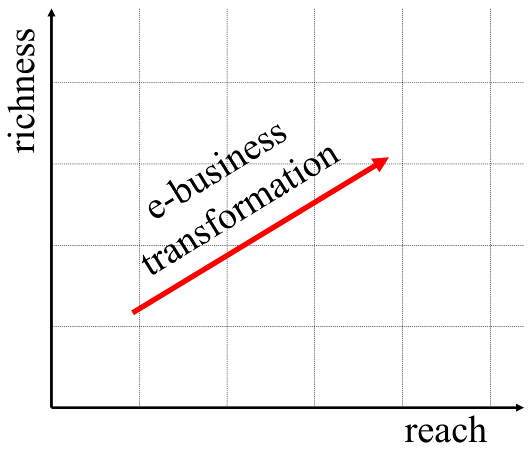

Figure 8: increasing reach and richness

Efficiency

Increase of efficiency of business is often a reason for the use of information technology. When the increase of efficiency is used only to reduce the costs related to existing business models without altering these, we do not consider this e-business.

When efficiency is increased dramatically, however, this may induce the possibility of new business models, for instance by enabling the cost-effective handling of far smaller transactions (micro-transactions) than possible in traditional business. If this is the case, we do speak of e-business, as information technology is indeed an enabler of new business models. In other words: efficiency alone is an e-business characteristic in extreme cases only – otherwise, it is a 'nice extra' as an addition to the other characteristics.

4.2 Restructuring business collaborations

E-business changes business relations by restructuring business collaborations along production and supply chains. In these chains, we can see the basic forms of *disintermediation* and *reintermediation*. When we take restructuring to the extreme, we get *deconstruction* and *reconstruction*.

Disintermediation

Disintermediation is the removal of a link in a production or supply chain (as illustrated in Figure 9) because it has become 'superfluous' through the use of e-business [Eva99, Tur02].

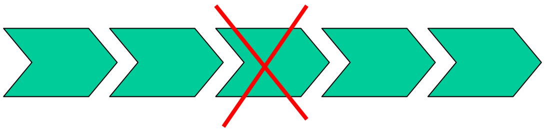

Figure 9: disintermediation

Typically, disintermediation applies to a link in a chain that has some kind of intermediary function between other parties in the chain. A typical B2C example is disintermediation in supply chains for consumer products where the retailer is removed because the producer (or distributor) of the goods has direct contact with the individual consumers through digital channels (typically, web sites). In the B2B world, we can find comparable examples, where suppliers of professional products (e.g. office or computing equipment) sell directly to user organizations.

Reintermediation

Reintermediation is the insertion of a new link in an existing production or supply chain [Tur02]. The new link provides new functionality to the chain that is enabled by the use of information and communication technology.

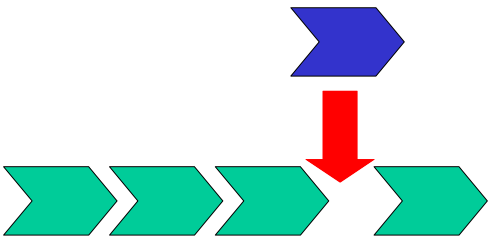

Figure 10: reintermediation

Reintermediation often applies to organizations with a new kind of intermediary function. Common B2C examples can be found in the retail world, where product comparison or integration sites take a new place in a supply chain between producers and consumers. A B2B example of reintermediation is the creation of electronic market places where products (or services) are traded between communities of suppliers and consumers, instead of pairs of partners.

Deconstruction & reconstruction

In disintermediation and reintermediation, a chain is modified by manipulating one single link. If we take the approach to the extreme, we deconstruct a complete chain into its constituent pieces (links). Next, we evaluate the added value of each piece, perhaps throw away a few, combine a few and add a few. From the results of this, we finally reconstruct a completely new chain [Eva99]. This new chain may follow a completely different business model than the old chain, but yet provide the same functionality to a market.

Clearly, deconstruction and reconstruction can most easily be applied in chains that are not so 'physical' in nature, e.g., information-intensive chains. A typical example is the travel world, in which the chains between providers (airlines, hotels, etcetera) and consumers (the travelers) have been completely changed by the introduction of e-business. In the traditional economy, most transactions were channeled through large travel organizations with many travel agencies close to the consumers (both private and professional travelers). In the electronic economy, we see that the role of travel offices is decreasing, that providers sell directly to consumers (some low fare airlines only use direct sales), that product integration and product comparison services have emerged, that physical travel documents (tickets, vouchers) are disappearing and hence the role of postal services is fading, etcetera.

4.3 New business directions

Based on redefined business characteristics and structures as discussed above, a number of new business directions can be distinguished. Below, we give a number of important examples – there is no aim to be complete.

True On-Time and Online Capability

The 'old economy' heavily relies on slow and asynchronous communication media, like the old-fashioned postal service. This means that direct interaction between business partners is very limited and 'time margins' are built into business processes to accommodate this. In e-business, we can have direct interaction between partners using electronic media like the Internet, thus paving the way for online business. Online business allows much tighter synchronization between partners, which enable 'true on-time' processes.

In the early days of e-business, being 'truly on-time and online' was a major goal to be achieved. A Web interface did not necessarily imply fully online transaction handling behind that. Nowadays, it is more and more taken as a default setting for business models, where transactions are completely performed online and real-time. An example is the travel industry, where actual bookings for air travel and hotels are made real-time and online.

Enriched Customer Relation Management

In the 'old economy', the nature of communication media typically enforces infrequent, coarse grain communication between partners. The cost of off-line, manual data processing prevents the management of detailed, up-to-date partner information. This makes customer relation management (CRM) rather limited. In e-business scenarios, interaction between partners can be fast and frequent. Online data gathering allows the management and use of very detailed and up-to-date information about partners. This opens the door to complete new forms of CRM.

Examples can be found in electronic retail applications that dynamically compose offers for customers, based on their current and past behavior. Note that in traditional retail, typically only transactions (sales) are recorded, leading to coarse pictures of client behavior. In electronic retail, the complete behavior of customers can be recorded in great detail, e.g., his catalogue browsing history, even when this does not lead to any transactions.

Integrated Bricks and Clicks

Many business organizations already have an established foot print in the 'old economy'. Recognizing that e-business offers new possibilities does not necessarily mean doing away with this established presence. So, an integration of 'old' and 'new' business is necessary, referred to as *integrated bricks and clicks*[8].

In this integration, two aspects are of utmost importance. In the first place, there should be synergy between the bricks and the clicks, such that the one offers added value to the other (for example, by offering additional services to business partners). In the second place, the demarcation between bricks and clicks should be flexible, such that both customers and business activities can be moved from the one to the other without disturbing business operation. Usually, the move is from bricks to clicks, but not necessarily so (if a clicks scenario fails, a bricks backup should be available in some business segments).

Multi-Channel Business Design

The introduction of e-business often means that multiple communication channels exist through which an organization can be accessed. This is certainly the case with integrated bricks and clicks as discussed above, where traditional communication channels (e.g., physical post, telephone) are operated alongside digital communication channels. But also in pure e-business, more than one channel may exist, e.g. e-mail, Web-based forms, digital voice response systems etcetera.

From a business point of view, two aspects are of paramount importance when using multi-channels: flexibility and synchronization. Flexibility should allow business partners to change channels without disturbing business relations. Synchronization must be taken into account into the business design to make sure that transactions conducted

[8] We use the term *bricks and clicks* to refer to the integration of the principles from the old and the new economy. Often we see the term *bricks and mortar* to refer to the old economy and *clicks and mortar* to refer to the integration of new and old (see e.g. [Jel05]).

over more than one channel still provide consistent results[9]. We refer to e-business setup taking this into proper account as *multi-channel business design*.

A multi-channel business design may be necessary for several reasons. An important reason is the existence of different customer groups, each of which prefers a different channel. We see this for example with general mail order companies, where older customers may prefer traditional channels and younger customers may prefer digital channels. Another reason is the use of different kinds of communication devices. We see this for example in m-business settings, where different kinds of mobile devices are used depending on the context of a user.

Completely Automated Business

In an extreme case of e-business, one may strive for business operation (at the operational level) without human intervention at all – thus, human effort is only required for management tasks (at the tactic and strategic levels). We call this business direction the *completely automated business*. Complete automation is typically only achievable if there is no manipulation of physical objects (see Section 2.3). This implies that only digital objects or services are manipulated *or* physical handling is completely outsourced to an external service provider.

Often, automation of operational processes cannot be pursued in its full completeness: humans may be needed to deal with exception handling. But for highly standardized digital objects or services, complete automation is *in principle* achievable. Note that even the operation and maintenance of the required computing infrastructure can be outsourced.

Time-Compressed Business

By integrating elements of the true on-tine and online business and complete automated business directions, one can obtain the time-compressed business direction. This means that e-business models can be used that are based on transactions that are executed in a fraction of the time span compared to traditional business models. This is caused by the fact that reaction of business partners can always be almost instantaneous (as they are always online and they can automate decision tasks). This business direction enables business models with high levels of just-in-time behavior.

Examples can be found for example in stock and currency markets, where fast-moving players obviously have their advantages over slow-moving players.

4.4 New business structures

Based on new business directions, new business structures can be defined that heavily rely on e-business characteristics. Below, we introduce important classes, again without the aim to be complete.

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[9] This is certainly true when new communication channels are introduced. For example, in the early days of electronic retail, consumers might place orders over the Web, then start doubting whether it worked and subsequently place the same order using a traditional channel (like a physical form per postal service) – leading to many double deliveries.

Supply to Demand Chains

Traditionally, the operation of many supply chains is producer-controlled: the produced decides what to produce when, 'pumps' it into a supply chain where at the end, and the consumer decides what to buy. Disadvantages of this business design are the fact that production doesn't meet consumer wishes qualitatively (consumers want different product than available) and quantitatively (there are too few or too many products – the latter often leading to substantial waste). Hence, this business design may be suboptimal in markets where consumer behavior is fast changing. Traditionally, more direct coupling between consumer behavior and producer activities was hard to realize because the necessary synchronization channels did not exist (or were far too costly).

To cope with the mentioned problems, one may go from a supply chain business design to a *demand chain* business design. In the pure demand chain design, a producer only produces a product after a consumer has ordered it, i.e., the operation of the chain is consumer-controlled. This is enabled by the fact that electronic channels enable fast and cheap synchronization between consumer and producer (even if there are many consumers), plus the orchestration of the intermediate links in a chain.

In a hybrid supply/demand chain design, we have a well-defined *customer order decoupling point*, at the producer side of which the chain operates in supply-mode, and at the consumer side of which the chain operates in demand mode. Where traditional business scenarios do allow hybrid chain designs, e-business allows for designs in which the decoupling point is moved much more towards the producer (i.e., a larger part of the chain is operating in demand mode).

Dynamic Partnering

The flexibility of e-business technology allows the 'on-the-fly' establishment of business collaborations between autonomous business organizations. This can differ radically from traditional collaboration forms. In the traditional forms, collaborations are typically set up before the actual business operation starts. Given the cost of such set up, these collaborations are often forged for prolonged spans of time (e.g., several years or even indefinitely). In the e-business form of collaboration setup, the partnership is created during business operation at the time that the functionality of a partner is actually needed. We call this *dynamic partnering*. In an extreme form, we have *just-in-time* partnering: choosing and binding a partner at the latest possible moment in order to be able to use as much context information (for example market conditions or case characteristics) as possible in choosing the best partner.

Dynamic partnering can lead to the establishment of *dynamic virtual enterprises*[10], i.e., collaborations that have a formal character (which can be based on electronic contracts [Hof01]) and that present themselves to third parties as a single business entity.

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[10] The term 'instant virtual enterprise' is also used to indicate a virtual enterprise that is created dynamically. For example, in the CrossWork project, instant virtual enterprises are created semi-automatically based on explicitly specified business goals [Gre07].

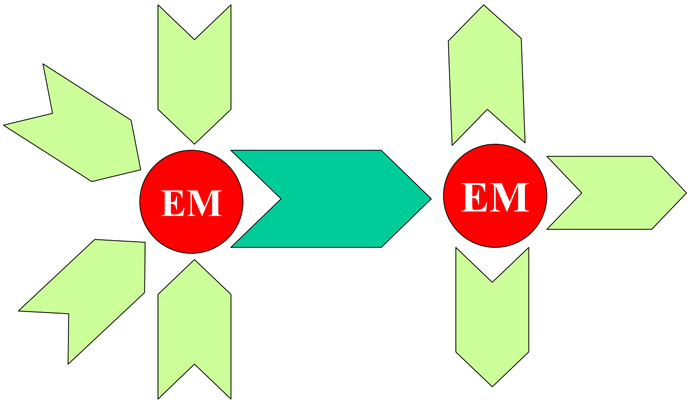


Figure 11: highly dynamic supply chain

Highly Dynamic Supply Chains

Traditionally, supply chains have limited flexibility with respect to the partners involved in a specific supply chain. An organization in a chain typically obtains a specific type of input objects from one or a small set of providers. Similarly, it typically delivers a specific type of output object a one or a small set of consumers. This inflexibility is related to the slowness and cost of traditional communication and collaboration channels.

E-business allows the design of supply chains with much more ‘routing flexibility’, i.e. the dynamic selection of input and output partners in a chain. In a highly dynamic chain, both types of partners may be selected completely on-the-fly, based on selection processes conducted on real-time electronic market places. This is illustrated in Figure 11, where the focus organization is shown in the center and both input side and output side of this organization are connected to an electronic market (EM) providing connections to many business partners.

The highly dynamic supply chain business structure is a specialization of the dynamic partnering business structure discussed before: partners are chosen dynamically, but for a specific reason (providing supplies or buying supplies).

Dynamic Service Outsourcing

Another specific structure of dynamic partnering is *dynamic service outsourcing* [Str00]. In this business paradigm, an organization chooses parts of its business process that it doesn’t consider core competence and decides to outsource these subprocesses to specialist provider organizations (for whom these subprocesses are indeed core competence). The decision to which service provider to actually outsource a specific piece of work at hand is taken dynamically – preferably just-in-time. Clearly, just in time outsourcing requires fast communication channels.

Dynamic service outsourcing can improve the competitiveness of the outsourcer in a number of ways. It can enhance the efficiency of its processes, as the provider can perform the outsourced subprocesses faster and/or cheaper. It can enhance the effectiveness of its processes, as the provider can perform the tasks it specializes in qualitatively better. Finally, it can greatly enhance the flexibility (also called agility) of the outsourcing organization, as the provider can be chosen dynamically, depending on both the case (e.g. customer order) at hand and the current market circumstances.

In an extreme case, an organization can outsource *all* its operational business processes, such that it only coordinates the operation of other organizations (and the business model of the organization is indeed based on agile synchronization of its service providers).

4.5 Combining the B aspect elements

In this chapter, we have seen a number of B aspect elements. These can be combined to be used for B aspect design or analysis. This can be done in several ways.

One typically starts characterizing an e-business scenario using the reach and richness (R&R) dimensions (and if applicable, the extreme efficiency characteristic). Based on that, the disintermediation and reintermediation (D&R) principles can be discussed (deconstruction and reconstruction in the extreme cases). Based on R&R, one can find new business directions. Directions and D&R choices can lead to new business structures. Using this way of combining the elements, on arrives at an approach as illustrated in Figure 12.

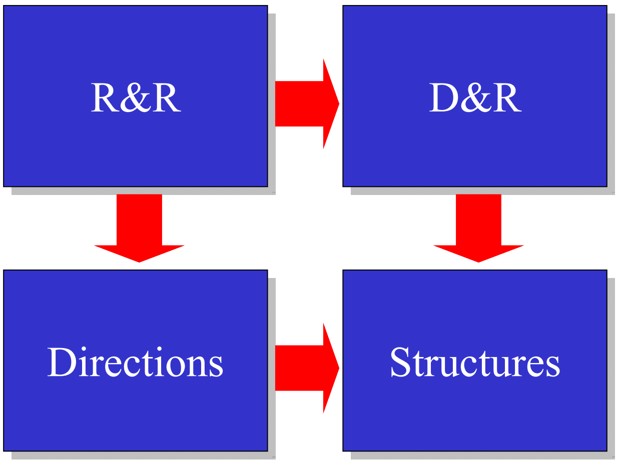


Figure 12: B aspect elements combined

Obviously, the elements can be applied in different orders too, for example a linear order from R&R, to D&R, to Directions and to Structures – or working the way back starting at the Structures.

5 ORGANIZATION ASPECT

In the previous chapter, we have discussed the business aspect of the BOAT framework. In this chapter, we continue our discussion with the organization (O) aspect. Again, the aim is to provide a short overview of relevant issues – for more elaborate discussions, the reader is referred to more detailed material.

Below, we first turn our attention to e-business organization structures. Next, we discuss how business processes can be placed in the context of these organization structures. In the next section, we explain how operations management is required to keep processes running and change management to keep structures and processes aligned with new developments, for instance in the business aspect. In the last section, we briefly show how concepts from the B aspect can be mapped to the O aspect.

5.1 E-business organization structures

A good understanding of organization structures is important for every type of business domain (see e.g. [Min92]). In e-business, however, we generally deal with complex scenarios, in which a clear structure of the business organization is essential for a decent understanding of the scenario. The dynamic nature of many e-business scenarios further increases the need for clear structure: one needs to understand what is subject to change and what is not[11].

In this section, we explore the structure of e-business organizations in a stepwise manner: we start with a very high-level picture and then refine this in a number of steps. After we are done with the refinement steps, we discuss how the business concepts of disintermediation and reintermediation can be operationalized using the developed structures.

Different roles

As we have seen in Section 1.1, we focus in this document on inter-organizational e-business scenarios, i.e., scenarios in which two or more autonomous business parties are involved (where parties can have diverse natures as discussed in Section 2.2).

Typically, we identify three roles of parties:

- *consumer*[12] (a party that requires a product or service),
- *provider* (a party that offers a product or service), and
- *intermediary* (a party that has an auxiliary role in getting product or service from provider to consumer).

[11] We will revisit this issue when discussing change management in Section 5.3.

[12] Note that we use the term 'consumer' in two very different ways: it indicates a type of party (an individual person as opposed to a business or government party) and a role of a party (consumer as opposed to provider). Although this may be confusing, the term is generally used in both these ways and circumvening this would lead to unusual terminology.

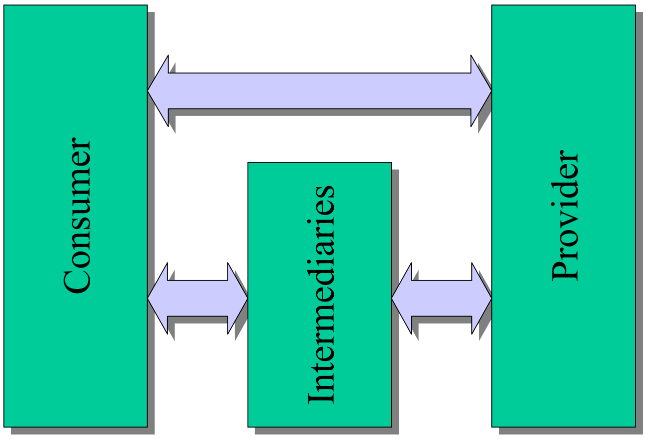


Figure 13: organization structure level 1

When we put the three roles of parties and their relations in a diagram, we get Figure 13. The parties can be of different types, as explained in Section 2.2.

For reasons of simplicity, we use one consumer and one provider in this diagram (and the sequel of this chapter). Although this one-to-one scenario is common in practice, scenarios exist in which multiple consumers and multiple providers may interact in an e-business collaboration. Extension of the one-to-one scenario to one-to-many or even many-to-many is rather straightforward though.

Note that *consumer* and *provider* are roles – one organization can be a provider in one e-business relationship but at the same time a consumer in another relationship.

The structure in Figure 13 may be clear, it contains too little structure to be of help is detailed design or analysis of e-business scenarios. Therefore, we refine this figure in a number of steps in the sequel.

Role of intermediaries and channels

In Figure 13, there is no distinction between different types of intermediaries. Often, however, an e-business scenario requires more than one type of intermediary, e.g., a broker that helps parties identify each other, a financial intermediary that can arrange the execution of payments between parties and a transport intermediary that arrange for the transport of physical objects between parties. This is shown in Figure 14.

Note that the shown intermediary types are merely examples. If the e-business scenario does not involve exchange of physical objects (see Section 2.3), a transport intermediary may be unnecessary. In a pure bartering scenario, a finance intermediary is unnecessary. Other scenarios, on the other hand, may require other intermediaries, e.g., for trust establishment or service aggregation.

The second extension in Figure 14 is the identification of multiple channels between consumer and provider through which information or e-business objects can be passed. Multiple channels may each serve a different business function (as explained below) or may serve the same business function in different ways (e.g., by means of different physical communication channels, like telephone or internet). The latter is commonly referred to as *multi-channeling* (this is related to the *multi-channel business design* discussed in Section 4.3).

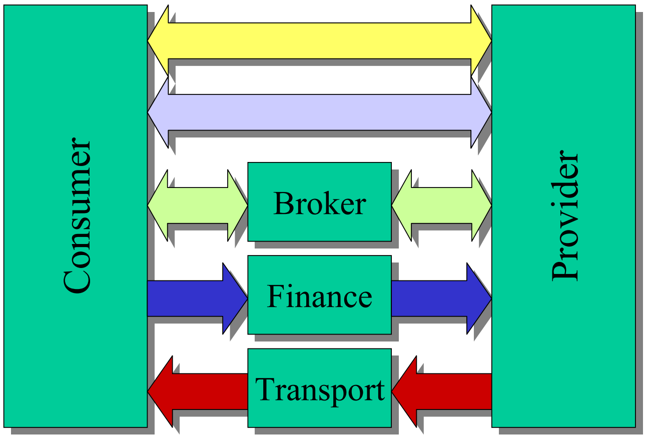


Figure 14: organization structure level 2

Front office versus back office

In Figure 14, the business functionality of both consumer and provider are shown as a black box, i.e., without any internal detail. To design or analyze an organization structure, we need to open up this black box.

The interaction between parties in an e-business context changes frequently, both as a consequence of changing business models (as discussed in Chapter 4) and of changing technology (as discussed in Chapter 7). The core activities of organizations typically do not change that frequently however. Take for example a telephone company. The interaction with its clients, for instance in the form of subscription packages offered, changes on a rather continuous basis. The core activities, providing infrastructure for phone calls and accounting its use, change only slowly over time.

The fact that internal business functionality and externally oriented business functionality changes at different paces implies that we have to make a clear decoupling between these two types of functionality. Without a clear decoupling, we cannot change the one without affecting the other.

We see the result of the decoupling in Figure 15. The core business functionality that is

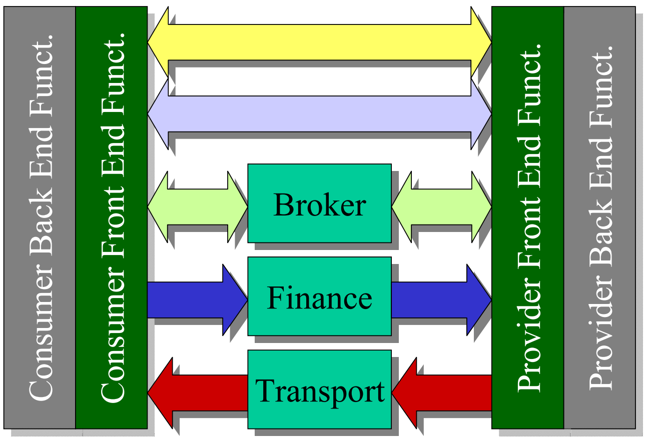


Figure 15: organization structure level 3

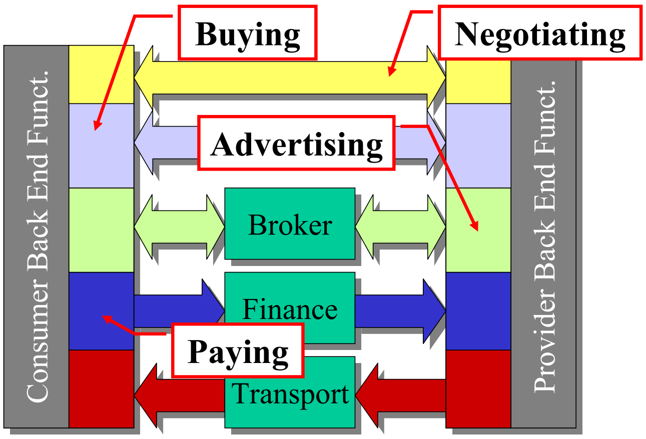


Figure 16: organization structure level 4 (with example functions)

of an intra-organizational nature is commonly referred to as *back end functionality*. The business functionality that is in contact with external parties is commonly referred to as *front end functionality*. In administrative organizations, both types of functionality are often called *back office* respectively *front office*.

Decoupling means that in a concrete situation, it should be very clearly defined what is part of the back end, what is part of the front end, and how the two ends interoperate.

Front office functionality and channels

The final refinement step we make here is the identification of individual functionalities in the overall front end functionality. A party (with consumer or provider role) has a number of distinct business functionalities that it requires to collaborate with external parties, such as advertising for the objects that it offers on a market, negotiating about prices or delivery conditions, buying objects and paying for bought objects (and typically quite a few more). As flexibility in functionality is of utmost importance to follow (or initiate) developments, it is usually a good idea to allocate these distinct business functionalities to distinct organization building blocks. This is shown in Figure 16, where the discussed example functionalities are shown for illustration purposes.

Three things are noteworthy here:

- It is of course possible to also modularize the back end functionality. We have not shown this here, as it is not too specific for e-business at the O level. When we move to the architecture aspect in the next chapter, however, this issue becomes more interesting – but that is for later now.
- If an organization employs multiple channels for the same business function (multi-channeling, as discussed before), it may be wise to have on organizational module for each channel. This further increases the level of flexibility of an organization.
- In case of B2C e-business, the C side usually has very limited business functionality. If so, the distinction between front end and back end functionality is not very helpful. A limited set of functional modules (e.g. only buying and paying) may be sufficient.

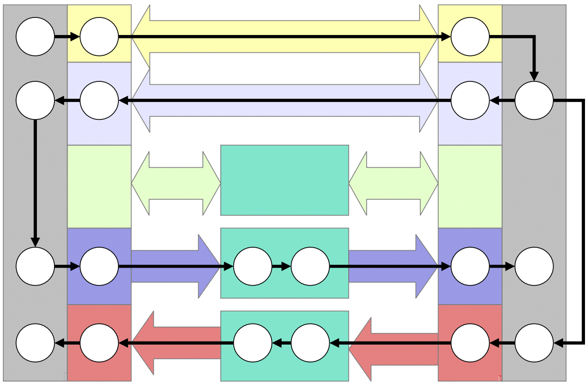


Figure 17: inter-organizational business process

5.2 E-business processes

E-business organization structures as discussed in the previous section describe the organization of business functions of participating organizations. They do not, however, describe how the various business functions are activated during the execution of an e-business collaboration. To capture this, we need to introduce e-business process models.

In essence, an e-business process model is a business process model as found in more traditional settings. Such a process model can be expressed for example as a UML activity diagram [Fow00], a Petri net [Aal02], or an event-driven process chain (EPC) [Wi08a]. But an aspect that is more important in e-business settings than in traditional settings is the allocation of activities (steps) in a process model to the parties in the e-business setting. This is so important, because the process is performed by multiple parties that are usually autonomous with respect to each other. In other words, the allocation of activities to partners determines the feasibility of the process model to a large extent.

We can go one step further and allocate the activities to functional modules of involved parties and allocate inter-organizational connections between activities to channels between partners. If we do so, we get a diagram like the one in Figure 17 (note that we have chosen a simple, informal process notation for reasons of simplicity here). This diagram gives a clear overview of how an e-business process progresses through the business functionalities of involved organizations.

5.3 Operations and change management

In operating an e-business organization, two aspects are of importance: keeping the existing situation operating and preparing for changing the existing situation. The former is called *operations management*. The latter, called *change management*, is extremely important in e-business – remember that change is the only constant in e-business. We briefly treat both types of management below.

Operations management

Clearly, operations management includes managing the internals of organizations involved in e-business – but that is not the focus of this document. We focus here on aspects specific to e-business: the inter-organizational relations between organizations. In this respect, operations management has three important aspects:

Synchronizing business relations between partners involved in an e-business relationship. This may involve managing relations defined in electronic contracts. Maintaining required levels of trust between business partners is a major issue here [Kee00].

Synchronizing process states of processes that are executed across multiple organizations in an e-business relation (as illustrated in Figure 17). This includes the handling of exceptional situations, which may require advanced automated mechanisms or escalation to human decision makers.

Synchronizing data states, i.e., making sure that the correct data is passed at the rights moments during the execution of e-business processes. Often, data synchronization relies on message passing between collaborating parties. In this case, communication protocols must be enforced.

Change management

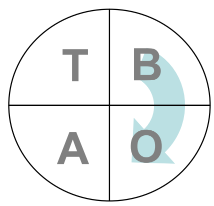
Change management is essential in an e-business organization to ensure that the organization is prepared to change and to actually implement changes. As we have seen in Chapter 1, changes can be triggered by changing market situations (requirements pull) or by changing technological possibilities (technology push).

An important aspect of change management is preparing for new and realizing organization structures, i.e., reorganizing the business functionality of an organization. To be able to do so without rearranging everything from scratch over and over again, organization modularity is extremely important: by organizing business functionality in appropriate modules (organizational clusters), many changes can be realized by manipulating individual organization modules.

Clearly, when organization structures are changed, process and data structures defined in these organization structures may need to be changed as well. But even without changing organizations structures, process and data structures may be subject to change.

In obtaining effective and efficient change management within an organization, the role of human resource management (HRM) is essential. The organization must make sure that well-qualified people are in pivotal places in the organization to enable changes. Apart from that, people must be in such position that they can indeed keep track of changes in the context of the organization. This makes continuous knowledge acquisition (education) a sine qua non in an e-business organization.

5.4 Mapping B elements to O elements



In Chapter 4, we have discussed the B aspect of e-business. As we have seen in this chapter, the O aspect is an operationalization of the B aspect. As such, we should be able to identify a clear mapping from B aspect elements to O aspect elements.

Below, we present a few thoughts on this issue – but without any intention to be complete.

Operationalizing reach and richness

In Section 4.1, we have seen the concepts of *reach* and *richness* as very basic ingredients to e-business models.

The concept of *reach* clearly is related to communication between organizations. Hence, we can operationalize it in terms of the channels between collaborating parties (see e.g. Figure 16). Geographical reach, for example, can only be increased if channels with the right characteristics[13] are placed between organizations, i.e. channels that help in bridging distance. Increased modal reach can be obtained by the use of multi-channeling, as discussed before in this chapter.

The level of *richness* that can be offered by an organization is heavily related to the functionality of the front office organization building blocks we find in the organization structure (see again Figure 16): the front office building blocks 'implement' the interaction with partners. To offer increased richness, the functionality of these building blocks has to be expanded, or new blocks have to be introduced into the organizational structure. For example, in the O aspect a new interactive advertising functional block may be added to obtain increased richness in the B aspect.

Operationalizing disintermediation and reintermediation

The business concepts or disintermediation and reintermediation can be easily operationalized in terms of the organization structures presented in this chapter.

If disintermediation or reintermediation pertains to an intermediary organization, it means removing respectively inserting an intermediary between two collaborating e-business partners. This can easily be illustrated in a structure as shown in Figure 15.

If disintermediation or reintermediation pertains to a party that is in between two other parties in the roles of consumer respectively provider, it means deleting this party from the chain and connecting the front ends of the other parties respectively inserting this party in the chain by reconnecting the front ends.

An example of operationalization of disintermediation is shown in Figure 18. The top of the figure shows a business chain from which a party is disintermediated. The bottom of the figure shows the result. Note that some intermediary organizations take the role of two intermediaries in the old scenario, but that there might also be two intermediary organizations connected 'in sequence' between the two main parties. The latter may occur, for example, if both organizations wish to keep using their preferred (and different) payment intermediaries; consequently, payments are handled by transactions between the two intermediaries.

[13] Note that we mean characteristics here in the O aspect, i.e., characteristics that determine the way channels are used by organziations. Characteristics of a technical nature belong in the A or T aspect.

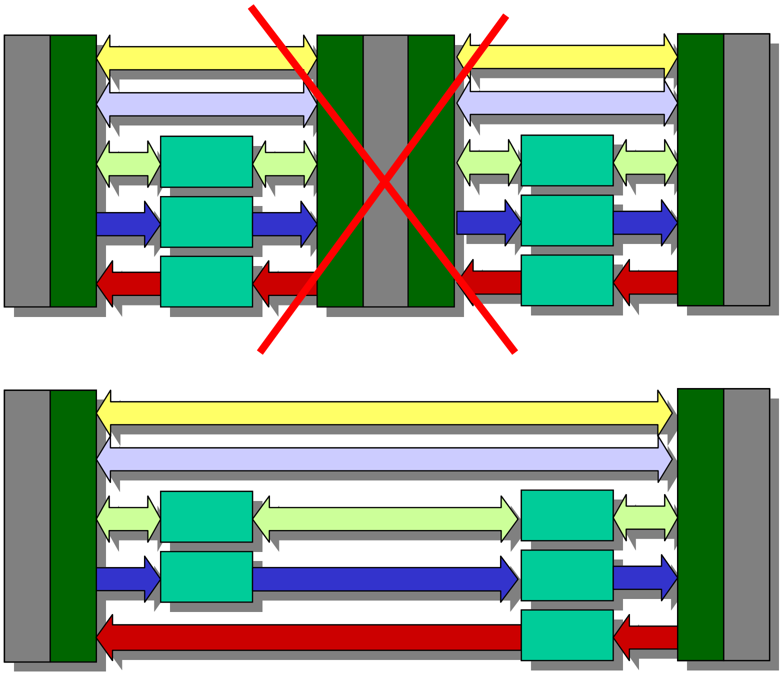


Figure 18: operationalized disintermediation example

6 ARCHITECTURE ASPECT

After having discussed the business and organization aspects of e-business in the two preceding chapters, we now focus our attention on the architecture aspect. Architectures are blueprints for e-business information systems, i.e., for the automated systems that support the business interaction as discussed in the preceding chapter. As such, architectures form the interface between the non-IT aspects and the IT-aspects of e-business.

Note that we focus on e-business-specific architecture elements in this chapter. There are good books available about software system architecture in general, e.g. [Bas03].

In the first section, we will see that architectures of e-business systems are necessary to provide structure in a quickly moving context. After the need for architectures has been established, we move to the contents of architectures. First, we see what high-level architectures are made of. Next, we zoom in to the level of medium-level architectures. Low-level architectures are at the level of detailed software engineering and hence outside the scope of this document.

6.1 The need for architecture

On the business side of e-business, we see a fast increase in required functionality of e-business operations. At the same time, an increasing level of quality is required as e-business operations are often mission-critical for organizations. Clearly, these two developments create a tension field.

On the system side of e-business, we see something similar. A quickly increasing spectrum of technologies becomes available. The complexity that the deployment of all this technology creates, however, requires an increasing level of structure to keep technology 'under control'. Again, this creates a tension field.

As we have seen already in Section 1.4, technology push and demand (requirements) pull forces reinforce each other, moving up the speed of developments in the area of e-business. This further stresses the two mentioned tension fields, as illustrated in Figure 19.

To keep the relation between business and system sides manageable, clear structures must be designed that describe the mapping of both sides to each other. These structures

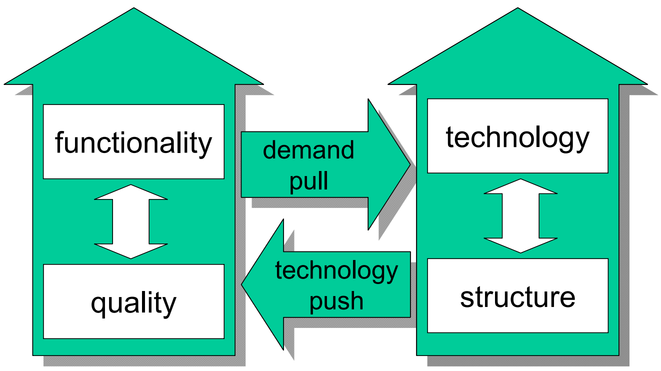


Figure 19: tension fields in e-business development

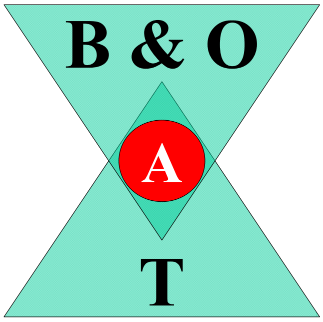


Figure 20: architecture as pivotal point

must be of an abstract nature, such that they are independent of specific, concrete choices made at either the business or the system side. In terms of the BOAT framework, these structures must form an 'interface' between the B and O aspects on the one hand and the T aspect on the other hand. This exactly is what the architecture aspect is about: it has a pivotal function between the other aspects, as shown in Figure 20.

As stated in the introduction of this chapter, architectures are blueprints for e-business information systems. More concretely, architectures specify the conceptual structure of e-business systems. We use the following basic definition[14]:

> *The architecture of an e-business information system defines that system in terms of functional components and interactions among those components.*

Architectures can be specified at multiple levels of aggregation. A high-level architecture specifies the structure of e-business systems in terms of large components. A medium-level architecture specifies more detail of (a part) of a high-level architecture, but still in terms of sizeable software modules. Low-level architectures go into even more details. Below, we first discus high-level architectures, then medium-level architectures – as indicated before, low-level architectures are beyond the scope of this document.

6.2 High-level architectures

A high-level architecture describes how the main software systems at the organizations participating in an e-business scenario interact. We use the following definition:

> *A high-level e-business system architecture defines the structure of an inter-organizational information system supporting an e-business scenario in terms of large functional software components and interactions between these components.*

There are several words in this definition that deserve some further explanation. An architecture describes a *structure*, which means that we should preferably use a description that clearly shows this structure, i.e., a clear diagram (as opposed to a natural language textual description). Next, a high-level architecture has an *inter-organizational* character. This means that a high-level architecture describes the information systems of all relevant partners, not of a single partner (therefore, we might also call a high-level

[14] Note that more elaborate definitions of the term 'architecture' exist too, which also pay attention to the way the structure of a software system is constructed (see e.g. [Gre08]).

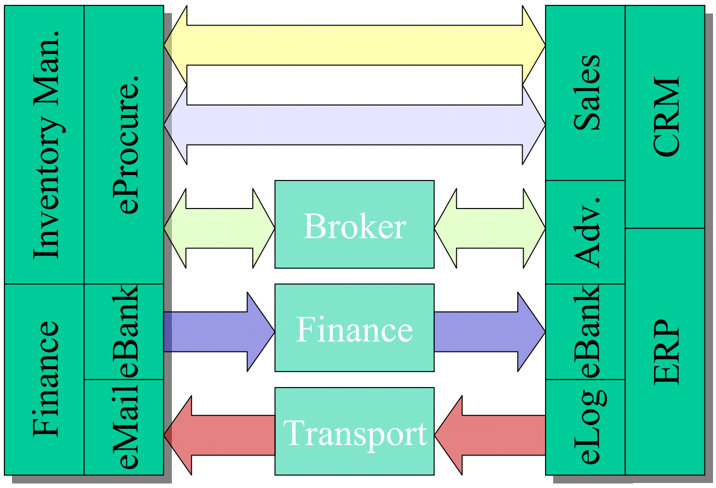


Figure 21: example high-level system architecture

architecture a ‘scenario architecture’). This is important, as the interaction between partners heavily influences the design of the high-level architecture. Then, the architecture is specified in terms of *functional* components, i.e., software modules that provide specific functions. As we have identified relevant business functions in the organizational (O) aspect, it is apparently a good idea to use these functions as a starting point. Finally, an architecture describes *software*. This means that we must limit the description to software components and interfaces between them. Hardware components (such as server machines) and physical connections (such as a glass fiber link) between these are not part of the architecture[15].

An example high-level architecture

Figure 21 shows an example high-level architecture. Here, the e-business system structure of two collaborating parties has been elaborated. The specific selection of modules obviously depends on the nature of the parties. If no physical goods are traded (see Section 2.3) for example, an ERP system is usually not very relevant. For the example scenario at hand, the system structure of the intermediaries is not considered relevant. This means that we treat their systems as black boxes. Note that this may be relevant in other scenarios, however.

In the example architecture, we clearly see the separation between front-end and back-end system modules, analogous to the separation in the O aspect. The front-end modules are based on front-end business functions (but note that there is not necessarily a one-to-one mapping between business functions in the O aspect and architecture modules in the A aspect). Back-end system modules are shown as well, as interfaces between front-end and back-end systems have an impact on system design choices (elaborated in a medium-level architecture).

[15] Note that relevant hardware details are decribed in the technology (T) aspect of the BOAT framework.

6.3 Medium-level architectures

A medium-level e-business system architecture further details (a part of) of a high-level architecture as discussed above. Typically, we focus on the system architecture of one single party (possibly an intermediary) in an e-business scenario. In other words: where a high-level architecture is inter-organizational, a medium-level architecture is intra-organizational (we might call a medium-level architecture a party architecture for this reason). This implies that a complete elaboration of a high-level architecture leads to more than one medium-level architecture, i.e., one per party involved in the e-business scenario.

In the medium-level architecture, we provide more details of how system modules are indeed connected, i.e., we pay explicit attention to the interfaces between system modules. We also add more details with respect to the use of software platforms, i.e., software modules that support the business-function-oriented modules identified in the high-level architecture. Note that a medium-level architecture contains software modules only (like a high-level architecture) – hardware elements are not elements in the architecture.

An example medium-level architecture

Figure 22 shows an example medium-level architecture, further detailing the system structure of the right-hand party of the high-level architecture shown in Figure 21. The relevant software modules of the high-level architecture are again shown in the medium-level architecture and interfaces between them are shown as arrows. We see that the CRM (customer relationship management) and ERP (enterprise resource planning) systems use a DBMS (database management system) as a software platform for information storage functionality. Also, we see that an EDI server software module is used to exchange logistics information with a partner and a web server software module to exchange sales and advertising information.

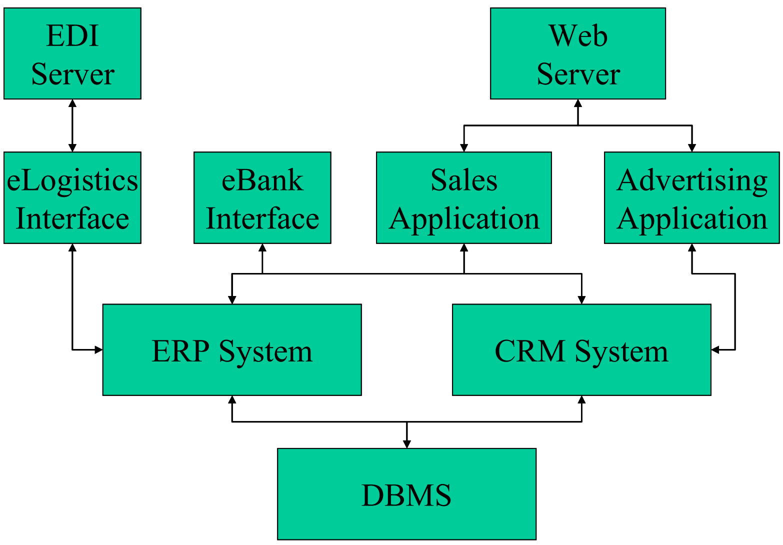
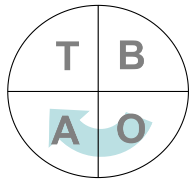


Figure 22: medium-level system architecture

6.4 Mapping O elements to A elements



As we have seen in this chapter, high-level architectures in the A aspect share structure with high-level organization structures in the O aspect. Obviously, this is not a coincidence.

Form is function principle

For e-business, a close alignment of business requirements and information systems is essential. This close alignment can be obtained by striving for isomorphism between organization structures (as defined in the O aspect) and information system structures (as defined in the A aspect). This is expressed by the 'form is function' principle [Gre03]: the structure of an architecture should follow the functionality it is designed for. Important elements identified in the O aspect should also be visible in the A aspect, and the way they are organized with respect to each other in both aspects must be a clear mapping.

In the simplest case, there is a one-to-one mapping between high-level descriptions in O and A aspects: each module in the O level corresponds to a module in the A aspect. Often, however, reality is a bit more complex than this. Compare for example Figure 16 (O aspect) to Figure 21 (A aspect): here we see that the numbers of modules do not match and that therefore, there cannot be a one-to-one mapping.

Modular design of information systems

In complex architectures (like those of most e-business systems), a strictly modular design greatly enhances the maintainability of the architecture. Modularity implies that an architecture is partitioned into functional modules, each of which plays a specific role in the architecture as a whole. This partitioning can be based on the partitioning of the organizational functions of an organization – following the 'form is function' principle as discussed above. Maintainability relates to a number of issues that are of high importance for e-business systems.

First of all, e-business systems (and thus their architectures) are subject to frequent change as a consequence of the volatile market they have to operate in – remember that in e-business, change is the only constant factor. A modular architecture design means that it is possible to replace (or add or delete) specific modules in the architecture, while leaving other modules as they are. This greatly enhances the level to which a system is 'future-proof'.

Secondly, most e-business systems are of considerable complexity. This means that it is usually not feasible to build such a system from scratch. Where possible, one should rely on existing modules where they are available on the market (so-called *common-of-the-shelve* (COTS) components) and only build new modules where functionality is so specific (or new), that ready-made solutions are not available. This is often referred to as the 'make-or-buy decision'. Nowadays, this question is more and more answered by 'buy', where bought modules are parameterized (tuned) for the context in which they have to operate. To be able to flexibly deal with the make-or-buy decision, a modular architecture is required, where modules are identified based on the high-level (O aspect) functions they perform.

7 TECHNOLOGY ASPECT

In this chapter, we discuss the fourth aspect of the BOAT framework: the technology (T) aspect. In the technology aspect, we discuss how specific information technologies are used to implement the information systems specified in the architecture (A) aspect (as discussed in the previous chapter).

In this chapter, we start with the 'bare basics' of e-business technology: Internet technology. After having covered that, we distinguish between two classes of advanced technology. First, we discuss infrastructure technology, i.e., information technology used to create a general, high-level basis for e-business information systems. Next, we discuss function-specific (dedicated) technology that is used for the implementation of specific functions or aspects of e-business information systems. In the last two sections, we pay attention to mapping issues between BOAT aspects: first to mapping from the A to the T aspect, then to mapping from the T to the B aspect[16].

Note that this chapter focuses on technology that is of special relevance for e-business information systems. Clearly, most technology for information systems in general is also applicable to e-business systems. Many technologies come (and sometimes go) – see for example Gartner's hype cycle report [Fen05]. Note also that it is not the purpose of this chapter to be complete, but rather to illustrate the role of technology in e-business. Books that provide a more complete or more detailed description of e-business technologies are available, e.g. [VaS03, Why01, Nel02].

7.1 The bare basics: Internet and Web technology

Obviously, the communication infrastructure on which most modern e-business systems are based is the Internet. Below, we briefly discuss the very basics of Internet and Web technology.

The Internet

The Internet is the global network that forms the communication platform for most modern e-business. We have already seen a few words about its history in Section 1.2. The Internet consists of a connected network of networks – which explains its name – to which Internet hosts are connected. Each host has a unique number, the internet address. An internet address has a hierarchic structure, based on the hierarchy of networks.

The basis for Internet communication between Internet hosts is formed by the *Internet Protocol* (IP) and the *Transmission Control Protocol* (TCP). The TCP protocol is defined on top of the IP protocol, reason for the fact that the combination is often referred to as TCP/IP (TCP over IP). TCP/IP defines a basic communication mechanism for the Internet. More specific protocols are defined on top of TCP/IP, like the Simple Mail Transfer Protocol (SMTP) for transmission of email messages.

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[16] Note that with discussing this mapping after the previously discussed mappings, we complete analyzing the aspect-pair-wise dependencies in the cyclical BOAT view. We revisit the topic of dependencies in the complete BOAT cycle in Section 8.3

The (World Wide) Web

The World Wide Web (WWW) or Web for short is a communication infrastructure using the Internet as its underlying platform. The *HyperText Transmission Protocol* (HTTP) is a protocol that supports the transmission of hypertext documents over the Internet. HTTP is defined on top of TCP/IP. Hypertext documents residing in the Web are uniquely identified by a *Uniform Resource Locator* (URL), an abstract address with a hierarchic structure showing the hierarchy of web domains. Top level domains are the last part of a URL – they indicate countries (like .nl for The Netherlands) or global topical domains (like .com for commercial organizations).

Hypertext documents are mainly specified using the *HyperText Markup Language* (HTML). HTML is a tagged language for specifying the layout of pages of human-readable information. A tagged language is a language that uses tags (specific labels) to identify characteristics in a text – in HTML for example the start and end of headings. HTML is mainly used to specify the layout of and links in Web pages.

Following the idea of a tagged language, the *eXtensible Markup Language* (XML) is a general-purpose tagged language that can be used to define specific tagged languages for specific purposes. As such, an XML-based language can be designed, for example, to specify financial transactions or to specify purchase orders between e-business parties. HTML can be defined using XML as well. XML allows the definition of the grammar of specific tagged languages.

Some brief remarks

Two rather trivial but important remarks need to be made here. Firstly, the Internet and the Web are not the same thing (although many use the terms in an interchangeable fashion). The Web is a hypertext based information structure using the Internet as underlying communication technology. Secondly, protocols and languages (for Internet or Web) are different things. Protocols are used to specify *how* communication takes place, languages to specify *what* is communicated.

7.2 Advanced infrastructure technology

Infrastructure technology provides a broad, general-purpose software platform for the implementation of e-business systems. It usually provides two main elements:

- a technological context in which functional modules (as identified in the architecture aspect) can be implemented; this context is a software engineering context that already provides primitives that cater for basic e-business operation (at some abstraction level, depending on the kind of technology).
- technological context facilitating the interoperability between functional modules; this context provides languages, protocols and mechanisms for exchanging information between software modules (where the abstraction level is again dependent on the specific kind of technology).

As infrastructural technology needs to provide quite a bit of functionality, it is of a medium to high level of complexity. To structure its functionality, the technology usually comes with a software architecture describing its structure. Note that an architecture of this kind may be easily mappable to an architecture in the A aspect of the BOAT framework if the infrastructure technology is structured at a high level of abstraction (i.e., close to business terms). The mapping may be harder in the case of lower-level infrastructure technology.

Below, we briefly discuss three classes of well-known infrastructural technology: ebXML, Web Services and multi-agent systems. For more detailed descriptions, the reader is referred to the material indicated in the reference list. Then we take a short look at hybrid platforms, which employ more than one class of infrastructural technology. Note that many infrastructural technologies at this level assume an 'underlying layer' (actually an infrastructure or platform too) of internet technology,

ebXML

ebXML provides a framework for the implementation of software that supports e-business processes [OAS06]. In the framework, parties that want to do business transactions with each other find each other through an ebXML registry (see Figure 23). This registry is an advanced form of electronic yellow pages server. As such, it supports an intermediary that provides for dynamism in e-business relations (contributes to reach – see Section 4.1).

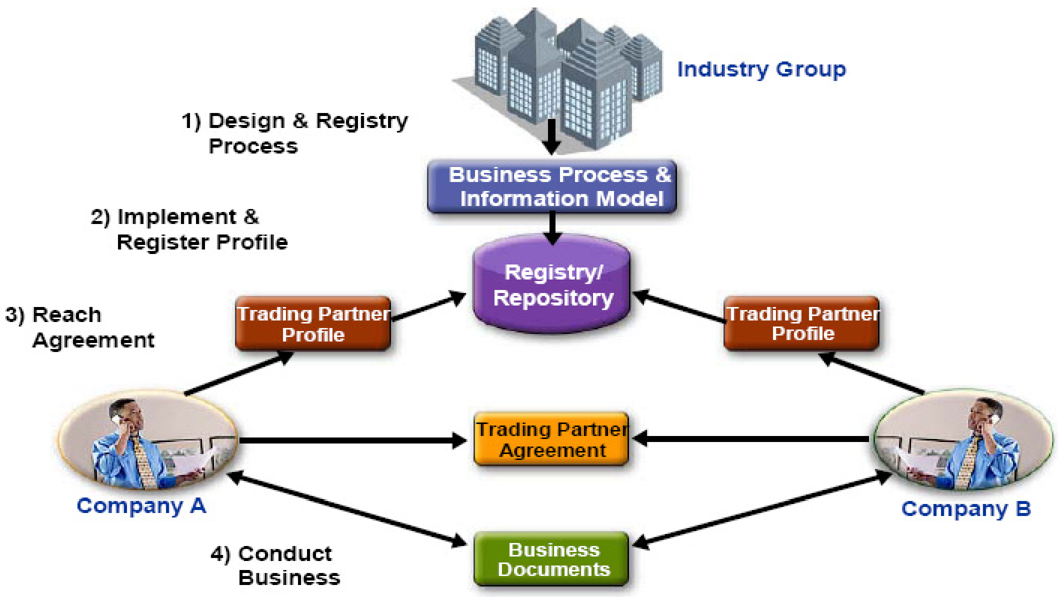


Figure 23: ebXML overview (from [OAS06])

As shown in the figure, business following the ebXML framework follows a number of steps. First, a process and information model is entered into an ebXML registry – this happens in the context of a specific industry group (related to a specific market). Based on this, companies operating in the market can register their trading partner profiles. Based on these profiles, companies can find interesting trading partners. Based on their profiles, a trading partner agreement is specified, which defines the business relationship between the companies. The companies can next conduct actual business by exchanging business document between their ebXML-compliant systems.

ebXML defines a high-level technological framework, in which business documents and interactions are standardized. To fully adapt to ebXML, organizations have to adopt this set of standards – which makes the threshold high for certain situations.

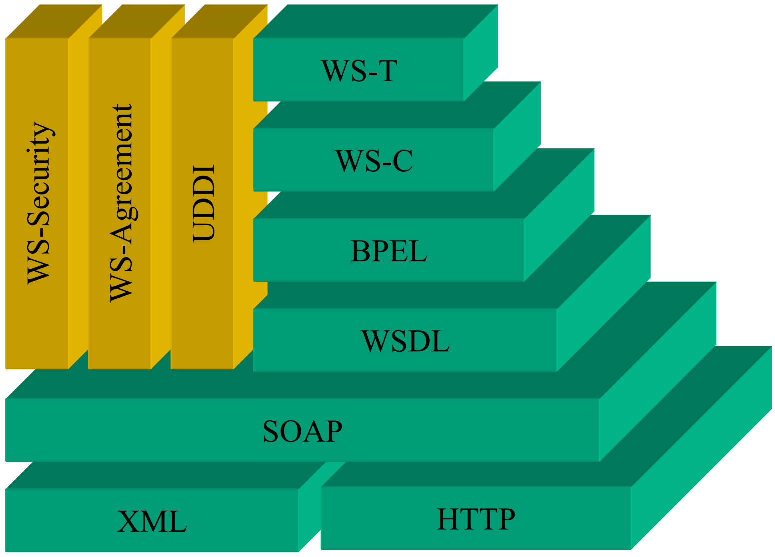


Figure 24: (partial) Web Service technology stack

Web services

The Web Services framework specifies and internet-based set of technology standards for loosely-coupled, distributed systems [Alo04, Pap07]. The basic concept of the framework is a *service*, which is an encapsulated piece of (business) functionality that can be invoked through a well-defined interface. A service can itself invoke other services, such that complex services can be composed from simple services.

The web Service standards are arranged in a hierarchy (called the *Web Service stack*), part of which is shown in Figure 24. At the bottom of the stack, we find the basic languages and protocols (at the lowest layer, the Internet basics discussed before), towards the top the more advanced ones. A central standard language is the *Web Service Description Language* (WSDL), which allows the specification of service interfaces. Next to the horizontal layers of the stack, there are a number of 'vertical' standards, which specify specific aspects of interoperability, like brokering, security, or agreement management. A standard for brokering is defined as *Universal Description, Discovery and Integration* (UDDI) [OAS04], an XML-based standard for registries in which organizations can advertise their services. Note that the stack as shown in Figure 24 is a 'mixed stack', as it shows language and protocols intermixed (remember our remark at the end of Section 7.1).

The Web Service stack is the basis for the *Service-Oriented Computing* (SOC) paradigm, which (as the name suggests) has its roots more in software engineering than business frameworks. The fact that the Web Services stack is a rather open framework makes it easy to start using it: one does not need to adopt the entire stack for simple applications. The implementation of full-blown e-business systems may, however, require quite a number of ingredients from the stack. When we use the SOC paradigm as a basis for the architectural design of information systems, we speak of *Service Oriented Architecture* (SOA).

Multi-agent systems

A technology class that is currently mostly used for e-business in a research setting is the technology of multi-agent systems (MAS). In a multi-agent system, autonomous software modules (the agents) reason internally and communicate with their peers to achieve goals that have been given to them. In doing so, they do not merely react to commands given to them, but act on their initiative to achieve the goals (this is also referred to as pro-active behavior).

The goal-oriented character of individual agents and the ability to communicate in agent communities makes them suitable for application in an e-business context (see e.g. [Fas07]). In such a context, agents can represent players in business settings that either collaborate or compete in specific markets.

Hybrid platforms

In complex settings, the use of one technology class may be too limited to build a system. The use of multiple classes may be necessary because multiple computing paradigms are required in different parts of a system or because COTS modules are used that require different platforms.

Figure 25 shows an example hybrid platform as used in the CrossWork project [Gre07] to support complex business processes in highly dynamic virtual enterprises (called *instant virtual enterprises*). Here, we see at the bottom a basic Internet layer – as can be expected. On top of that, we see both a MAS and a SOC platform. In CrossWork, this choice was made because one half of the system (called front-end in CrossWork) required goal-oriented reasoning technology, whereas the other half of the system required technology that would facilitate interoperability to COTS modules in a distributed topology. As shown in the figure, within the MAS respectively SOC platforms, more specialized technology is embedded: business process management (BPM) technology to handle business process specifications in the MAS platform and workflow management (WFM) technology to execute business processes in the SOC platform. To enable communication to human decision makers, a user interface (UI) platform has been added on top of the other technologies.

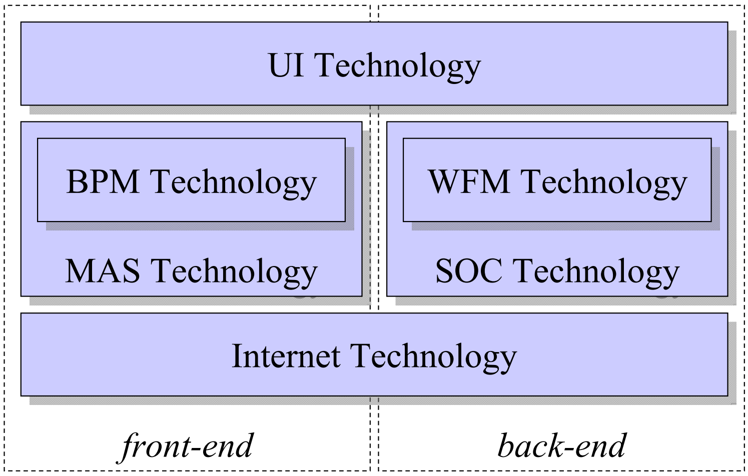


Figure 25: CrossWork hybrid platform

7.3 Function-specific technology

In the previous section, we have discussed general-purpose software that forms the basis for entire e-business systems. Apart from this, there is function-specific information technology. This technology can be subdivided into two classes: technology related to specific aspects of general business functions and technology related to specific business functions. We briefly discuss both classes below.

Aspect-oriented technology

Aspect-oriented information technology supports specific aspects of (a range of) business functions. Mostly, these aspects belong in the non-functional category: they do not relate to *what* functions do, but *how* they do it. Typical aspects are for example security, transactionality [Wan08], performance and availability. As such, aspect-oriented technology can be related to a range of modules in the organization (O) and architecture (A) aspects – this in the sense that the technology supports specific characteristics defined for these modules.

An example technology from the security aspect is cryptography technology [Kat07], which can be used to provide security in a number of business function support systems (such as electronic payment systems or electronic contracting systems). Two basic forms of cryptography can be distinguished: *symmetric* and *asymmetric cryptography*. Symmetric cryptography relies on a single secret key that must be available to two business partners, as illustrated in Figure 26. Asymmetric cryptography uses a combination of a public key that is exchanged between business partners and a secret key that remains with one partner, as illustrated in Figure 27. Asymmetric cryptography technology is the basis for *public key infrastructure* (PKI) technology [ITL97], which underlies many security schemes in modern e-business systems.

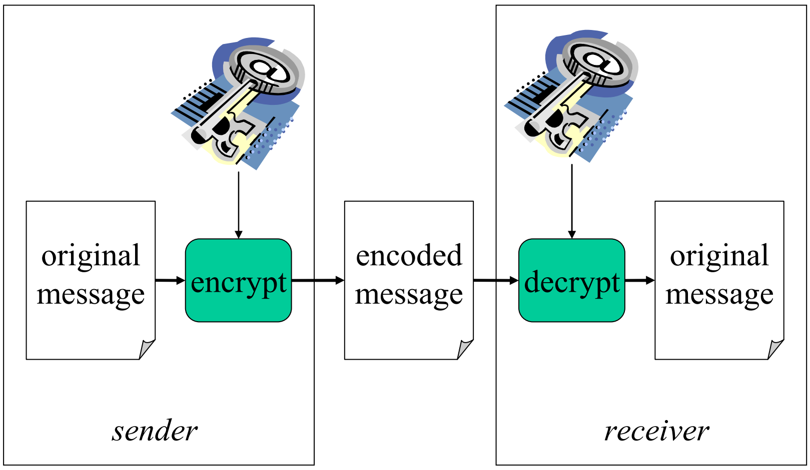


Figure 26: symmetric cryptography

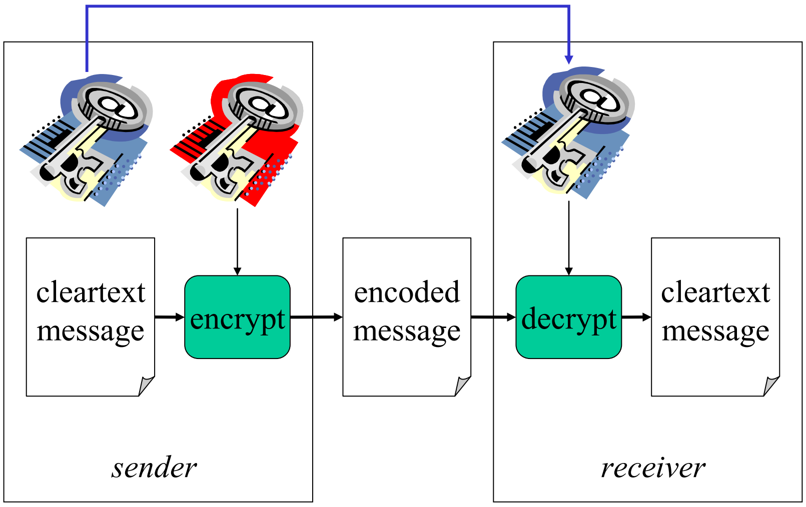


Figure 27: asymmetric cryptography

In the performance aspect, we find technologies that cater for advanced load balancing between e-business application servers and technologies that perform distributed caching of digital objects such that extended reach does not degrade performance. In the availability aspect, we find replication technologies that enable the deployment of multiple copies of specific functional modules (of databases), such that the failure of one copy will not cripple or even disable an entire e-business system.

Function-oriented technology

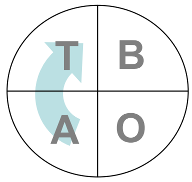
Function-oriented technology provides automated support for specific business functions. As such, it typically supports only a fragment of a complete e-business process. Function-oriented technology can often be related to specific modules as identified in the organization (O) and architecture (A) aspects.

There are many types of technology in this category. Examples of function-oriented technology types are:

- electronic catalogue systems, i.e., information systems that support the creation and the use of electronic catalogues (as used for example in retail web sites);

- electronic payment systems [OMa01, Pár05], which provide the functionality to perform financial transactions in an electronic way; these include gateways to traditional payment systems, but also systems that manage ‘digital cash’;
- electronic contracting systems [Ang06], which provide the functionality to establish and monitor complete contracts between business partners in an electronic way;
- business intelligence and data warehousing systems [Inm01], which provide the basis for functionality to store and analyze large volumes of data (e.g. browsing and transaction histories) to provide input to customer relationship management (CRM) systems and tactic and strategic decision making.

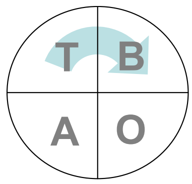
7.4 Mapping A elements to T elements



Technologies in the T aspect of BOAT are chosen to realize (or in another term ‘embody’) the architecture specified in the A aspect. The mapping from A elements to T elements depends on the category of T elements – as we have already discussed above:

- The basic Internet technologies underlie almost any modern e-business application. As such, they can often be assumed to be present ‘by default’ and hence do not show up in mappings between A and T aspects.
- Infrastructural technologies and aspect-oriented technologies typically underlie a complete architecture (or a major part of it). As such, they typically are not related to specific modules specified in the A aspect, but form a ‘basis below’ the modules.
- Function-oriented technologies typically support very specific functions and can hence be related explicitly to individual modules identified in the architecture in the A aspect.

7.5 Mapping T elements to B elements



As we have seen in Section 3.2, the BOAT model must often be used in the ‘wheel mode’ in an e-business context. This means, that we have to think about the mapping from T aspect elements to B aspect elements too to ‘make the wheel go round’. In other words, we have to think about the technology push aspect of e-business developments.

It is not easy, however, to speak in general terms about relations from T aspect elements to B aspect elements. We can give a few examples give some examples here, however, to illustrate possible relations:

- Obviously, the use of communication-oriented technology elements may have an impact on the reach element in the B aspect (see Section 4.1): a more advanced communication platform can result in extended reach (typically modal reach, sometimes geographic reach).
- Obviously, the use of multi-media technology may have an impact on the richness element in the B aspect: the use of a full spectrum of media can increase the richness of the communication to business partners.

- Specific technology classes can even directly foster the development of new business forms: the use of e-contracting technology opens new doors towards the formation of dynamic virtual enterprises (see Section 4.4), for example.

But a general 'recipe' does not exist for mapping T to B aspect elements. This is the reason for the fact that 'discovering' new business models based on emerging technology is still an art in itself.

8 BOAT AS AN ANALYSIS INSTRUMENT

In the chapters of this document so far, we have explored the e-business space along a number of dimensions as outlined in Figure 5. This provides a conceptual 'tool' for analyzing and designing e-business scenarios, but does not yet explain how to 'handle this tool' in practice. Therefore, we provide guidelines in this chapter of how to use the theory in this document for the following tasks:

- classify an existing e-business scenario (Section 8.1);
- analyze an existing e-business scenario (Section 8.2).

After describing the basic way to perform these tasks, we next pay special attention to two additional issues to obtain a complete analysis (or design):

- adding the time aspect to describe e-business developments (Section 8.3);
- getting an overview of the major dependencies between elements in the four BOAT aspects (Section 8.4).

8.1 Classify scenario

An existing scenario can be classified using the following steps:

1. Determine the scope of the scenario, i.e., decide which organizations are included in the scenario and which are excluded. Note that is not always a trivial task, certainly in complex supply chains or business networks. If this step is problematic, it may be an indication that one is actually trying to classify a combination of scenarios.
2. Classify the scenario in terms of the parties involved (see Section 2.2). If this step is problematic, it may be an indication that the previous step has not been performed correctly.
3. Classify the scenario in terms of the objects manipulated (see Section 2.3). Again, if this step is problematic, it may be an indication that step 1 has not been performed correctly.

8.2 Analyze an existing scenario

An existing e-business scenario can be analyzed using the following steps:

1. Classify the scenario as described above (Section 8.1).
2. Describe the four BOAT aspects in global terms (see Chapters 4 to 7). Make diagrams or graphical models where possible.
3. Analyze the mappings between the BOAT aspects in global terms. Make diagrams or graphical models where possible.
4. Decide which BOAT aspect(s) are most relevant for the nature of the scenario. Most relevant aspects are usually those that distinguish the scenario best from similar scenarios. Preferably, choose no more than two aspects.

5. Analyze the results of steps 2 and 3 in more detail, making sure that most attention goes to the aspect(s) identified in step 4.

8.3 Analyzing e-business developments

As we have seen, the field of e-business is a field with rapid developments. Therefore, it is often interesting to analyze an e-business scenario over time, i.e., to analyze its development.

Analyzing past developments

When analyzing past developments (which have been completed at the moment of analysis), typically two ‘moments in time’ are chosen:

1. Past
2. Now

For each moment in time, a BOAT analysis is performed as outlined above.

Analyzing future developments

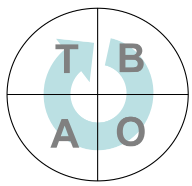
When analyzing future developments (studying possibilities for scenarios to be realized), it is often a good idea to think in terms of three ‘moments in time’:

1. Now
2. Far Future
3. Near Future

It is often worthwhile to think about the *Far Future* first to explore possibilities in an ‘ideal world’ in which extreme ideas are realizable. This avoids thinking in terms of too pragmatic ‘current limitations’ (e.g. of technology). When a ‘vision’ has been established for the *Far Future*, the *Near Future* can be deduced be interpolating between *Now* and *Far Future*.

For each of the three moments in time, a BOAT analysis is performed as outlined above.

8.4 BOAT element dependency diagram



After an analysis of an e-business scenario has been made, the most important elements and their dependencies can be drawn in a BOAT element dependency diagram (BEDD). In A BEDD, al four mappings between BOAT aspects are summarized – as such, it represents the complete wheel model as introduced in Section 3.2. The mappings are summarized by mentioning the most essential elements in each aspect and using arrows between elements in different aspects to show dependencies between them.

An example BEDD is shown in Figure 28. In this figure, we see a summary of an analysis of an e-business scenario about dynamic generation and delivery of multi-media digital goods. The arrows in the picture show that there is a heavy dependency between

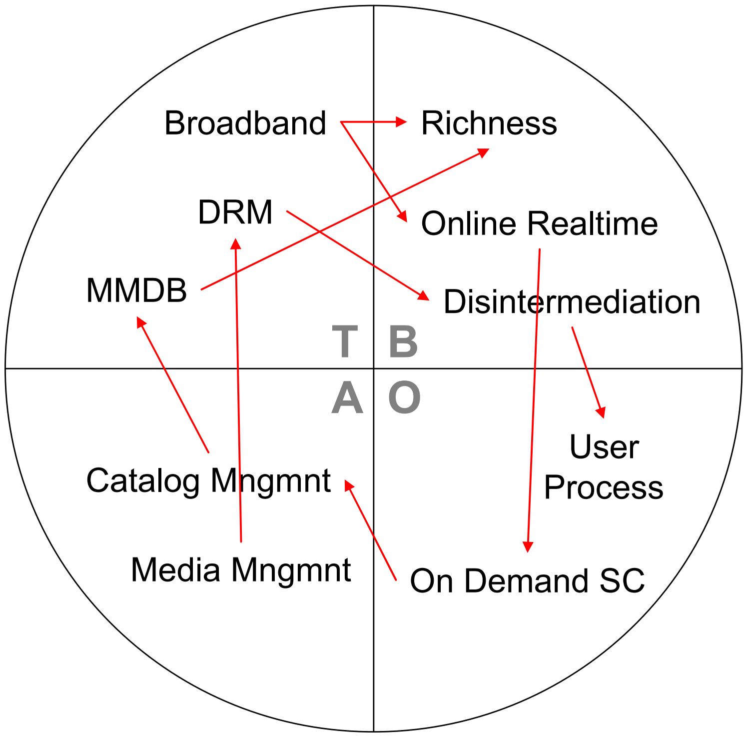


Figure 28: example BOAT element dependency diagram

the T and the B aspects: the boundary between these two aspects has the most arrows crossing it (compared to the boundaries between the other aspects).

9 CONCLUDING REMARKS

As indicated in the beginning of this reader, e-business is a very fast-moving domain. This implies that many details have a rather volatile character: what is modern today may be old-fashioned tomorrow – either in terminology or in technology, perhaps even in essence. Most important in this domain is therefore to understand the 'grand' structures and relationships that are not that susceptible to change. This overall view is what this reader has tried to convey. Of course, to be able to analyze current scenarios in detail, thorough understanding of 'volatile details' is necessary too.

Given the complexity of the e-business domain, a good separation of concerns is required to understand it. We have presented a multi-dimensional analysis space and the BOAT framework as an operationalization of one of the dimensions. The BOAT framework is a tool aimed at separation of concerns. But as the various aspects of e-business have an important interplay, the relations between the aspects must be given enough attention (as suggested by the sections on mappings between aspects). This implies that a good e-business analyst (or designer, for that matter) must always consciously balance between separation and integration of aspects (often in an iterative fashion).

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