

Online Service Quality of Web-based E-Mail-Services An Empirical Study For The German Market

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Abstract

E-mail services represent an essential part of the IT landscape of enterprises. Besides in-house hosting, every company can make use of offers from specialized Application Service Providers (ASPs). Former research has shown a lack of transparency in the market for web-based services.

This paper summarizes the results of a study on professional web-based e-mail services catering to the German-speaking market. This research mainly addresses following questions: What are the similarities and differences between the various services in the market? To which extent do the offered services meet a corporation's requirements? What kind of methodology can be used to analyze and to compare web-based services? And, with that in mind, do web-based e-mail-services represent a serious alternative to in-house hosting of e-mail-services? To answer these questions we compared information of selected service providers on the basis of a multi-scenario utility analysis.

1. Introduction

In the last few years, simplified communication via the Internet allowed companies of all sizes and sectors to outsource single functions or even entire business processes to external service providers [18]. With the proliferation of the Internet as a communication and collaboration medium, the number of enterprises specializing in delivering outsourced services rose. Web-based IT services, starting from infrastructure provision right through to management of complex applications, including associated support and permanent improvement and enhancement of the applications, were increasingly provided by specialized service providers. These services were able, through global networking, to deliver their services

independent of location, which allowed them to reach a huge number of potential customers.

Consequently every company today has to make a choice, to either carry on providing its own IT services, or, alternatively, to outsource these services to external Application Service Providers. The decision for or against outsourcing has to be made by every company individually, with consideration of its own competencies and goals, since both alternatives imply several advantages and disadvantages [5]. While outsourcing often leads to lower costs and higher flexibility and at the same time allows access to professional services and concentration on core competencies, placing the IT-services in a third party's hands also means losing part of the control over the used applications and the processed data [21].

One of these IT-services which has continuously grown in importance over the last years and which, consequently, has increasingly been offered by Application Service Providers is web-based e-mail. Electronic mail represents an indispensable medium in today's internal and external business communications. Independent of a company's size and sector, many processes rely heavily on e-mails in today's business world [8]. Thus, the availability of a professional e-mail solution is among the basic requirements for an enterprise's IT landscape. Just like many other IT services, web-based e-mail-solutions are offered by a plethora of national and international service providers. The available services differ in many aspects, ranging from functional and through to security characteristics and recurring costs. As known from former research suppliers of web-based services often have difficulties regarding the configuration, the display and the communication of the web-based services. Therefore, an extensive knowledge is necessary for a sustainable analysis and well founded comparison a web service suppliers. The lack in evaluation knowledge of potential web-based service buyers is a chief cause to the humble development and enforcement of the web-based service model in general [19].

The study presented here was conducted in January 2007 at the Institute of Information Systems at the Humboldt-University Berlin in Germany. We aimed at analyzing available products in the market for web-based e-mail services in order to determine their adequacy for use in a business environment. Furthermore, we wanted to know to which degree the typical requirements of potential customers could be fulfilled by the service providers and whether the services currently available represent a serious alternative to services delivered in-house. Finally we tried to identify the services that would generate the highest utility for demanding companies. We focussed on the German-speaking market; that is, providers in Austria, Germany and Switzerland. This enabled us to make an equitable comparison between providers from countries with a similar regulatory and business environment.

The remainder of this paper is structured as follows. We first introduce web-based services in general and web-based e-mail services in particular. Secondly, we present the latest developments and trends in the national and international market for e-mail services. For our study of services available in the German-speaking market, we used a utility analysis based on empirical data. Information gathering was conducted through questionnaires. Assumptions that had to be made for the utility analysis, in particular concerning the pre-selection of providers, the evaluation criteria and part-worth utilities, are discussed in the third section. An in-depth analysis of that information is presented in the fourth section. We have visualized the characteristics displayed by the studied services and identified the services, which best fit the different business requirements. In addition, we analyzed the extent to which the services fulfilled the defined, business-oriented requirements.

The fifth section summarizes our findings, poses unanswered questions and gives an outlook on upcoming developments and further research.

2. Web-based Services

Global networking provides companies of all sizes with various opportunities to outsource parts of their information technology infrastructure, such as applications and support, without compromising the quality or functionality of the service. Not only does outsourcing allow companies to focus on their core competencies, it also reduces costs in many cases [17]. After outsourcing the IT-services, these are delivered by Application Service Providers (ASPs). On the basis of a leasing contract or pay per usage Application

Service Providers do not only provide the required application, but also care for enhancements and maintenance of the service and deliver the necessary application support for the end users [21]. For the service provision, the ASPs operate the needed infrastructure in the form of a central computer centre on their own, or through the help of a network of partners [12, 18]. The specialization of providing applications for other companies allows the service provider to realize positive economies of scale, which is forwarded to the customers through an attractive price. A favorable price is not the only driver for outsourcing. Customers also get access to technical expertise, which would be unreachable with in-house hosting or which would at the very least be accompanied by overly high costs [12]. These advantages are not, however, completely free from sacrifice: dependency, which occurs for a company while outsourcing services to an external service provider may be a disadvantage. Thus widely accepted interfaces for the import and export of structured xml-data will become more and more important for flexible and loosely coupled service orientated architectures (SOA).

The access to the service bundles delivered is, in case of web-based services, provided through the Internet. The technical realization underlying the access is individually definable and differs depending on the application and the service provider [11]. While Application Service Providers in general offer various applications and services, our study focussed on a special IT service: web-based e-mail services.

Electronic mails as a communication medium play a major role in most companies nowadays. Both, primary and secondary value-adding processes benefit from the fast, secure, inexpensive and reconstructible way of communication and collaboration. Thus, e-mail solutions are among the basic applications in IT architecture and are deployed by almost every company.

Consequently, web-based e-mail solutions, accessible through a graphical web-interface, are offered by many ASPs. Despite the importance for companies, the global and national markets for web-based e-mail services are still in their infancy.

In October 2006 Germany's Federal Network Agency published, for the first time, a study on the German market of web-based e-mail services. The authors examined both B2C and B2B market and computed, for the German private customer's market, a volume of 3.7 bn € [9]. This large amount is result of the fact that volumes of related services such as web portals, web hosting and even internet accesses were included since they could not be clearly distinguished from e-mail services. The overall market volume for e-

mail-services in B2B therefore is expected to be much below that figure.

The above is confirmed by analysts of the market research institution Gartner Group. In a report published in November 2006, which focussed on the global B2B market for web-based e-mail services, analysts calculated an overall market volume of \$150 million, containing turnovers for pure web-based e-mail services only, and excluding turnovers for other related services [3]. Even though the figures published by Gartner are seen as being much more precise, the very different dimensions of both results show that the market for web-based e-mail services is still in a period of low transparency [9]. Additionally, in a study conducted by the Gartner Group, analysts researched the size of companies which resort to Application Service Providers in order to deliver e-mail services. They found that the outsourcing of e-mail services was almost solely done by small and medium-sized enterprises (SMEs) with less than 500 employees [3].

According to Gartner analysts, the Total Cost of Ownership (TCO) for an in-house hosted e-mail solution amounts approximately to \$10 per user and month, which can and should be used when deciding for or against outsourcing of a company's e-mail solutions [3]. We used this value as an orientation for evaluating the Application Service Providers products which were examined in our study.

For the future development of the market for web-based e-mail services, Gartner analysts are cautious as a result of the exorbitant and unfulfilled expectations around the year 2000. They expect that due to the increased use in companies with more than 1,500 employees, a slow but constant rise of demand for web-based e-mail services will be observed.

3. Empirical study

The basis for the analysis and evaluation of web-based e-mail services is the definition of product requirements, which must be geared towards the demands of potential customers. Since different customers may stress different evaluation aspects, the utility analysis uses different methods of weighing the requirements. Here, the weighing was postponed until the phase of calculating the services' utilities. We first identified five different evaluation or utility categories to examine the offered e-mail services: functionality, quality, security, trust and costs. The named categories reflect the knowledge that a web-based e-mail service and all services coming with it have to fulfill both functional and non-functional requirements, no matter whether provided in-house or externally by a service provider [15]. Whilst web-based service functionality

and service quality, security and costs are commonly used categories for evaluating software products concerning non-functional aspects, trust towards the service provider is of extraordinary importance if the web-based service is provided as a service due to the strong dependence of a service consumer on the provider.

To each of the five chosen utility categories we then assigned multiple evaluation criteria.

3.1 Evaluation criteria

Functionality: As the first evaluation category of web-based e-mail services, functionality sheds light on the capabilities of a service to solve typical tasks for end users. The functional requirements are noted and explained in table 1.

Table 1: Functional evaluation criteria for web-based e-mail services

No.	Functionality: Name and description
F.1	Inbox* : Existence of an inbox to store incoming e-mails
F.2	Outbox* : Existence of an outbox to store e-mails that were sent
F.3	Drafts* : Existence of a folder to store drafted e-mails
F.4	Address book* : Existence of an address book to store and manage e-mail contacts
F.5	Spam filter : Existence and extent of a spam filter
F.6	Auto-reply : Existence and functionality of an auto-reply agent
F.7	HTML-mailing : Capability to create and read e-mails in HTML-format via browser-interface
F.8	Data analysis : Capability and functionality to analyze stored e-mail data
F.9	POP3/IMAP-Access : Capability to synchronize e-mail server content and local e-mail clients
F.10	Storage time : Maximum time period to store received and sent e-mails
F.11	Max. e-mail size : Maximum size of incoming and outgoing e-mails
F.12	Storage size : Overall size of storage for e-mails
F.13	Fax-functionality : Integrated capability to send and receive facsimiles

Typical functionality requirements for web-based e-mail services, which are usually displayed by business customers, were collected from different sources such as market analyses, market forecasts and expert discussions. We have defined the most essential ones as exclusion criteria and marked them with an asterisk. E-mail services, which do not satisfy these minimum

requirements, cannot be understood as mature communication solutions.

Quality: With the second category's criteria we examined the service quality of the available products, thus the services' reliability and continuity. Like functionality, the quality of a service is to be seen as a very basic evaluation criteria, as an e-mail service can only be used successfully if the entire functional range is always and reliably available. The assigned and used evaluation criteria, given in table 2, can therefore also be subsumed as service level agreements and thus as contractually assured quality of service.

Table 2: Qualitative evaluation criteria for web-based e-mail services

No.	Quality: Name and description
Q.1	Service availability: Contractually assured availability of the e-mail service (yearly average)
Q.2	Server response: Contractually assured response time for web and mail servers (yearly average)
Q.3	Availability of support: Contractually assured availability of technical user support
Q.4	Free of advertisements: Degree to which services are free of any advertisement

Security: Security aspects are considered more and more essential for the conception, implementation and operation of information systems, since unscheduled system breakdowns or non-authorized access to sensitive business information can endanger a company's existence [6, 10]. According to the CSI Computer Crime and Security Survey 2007 [14], the information technology fact report 2008 [8] and relevant security contributions [2, 20] we selected security related evaluation criteria for web-based services. As found by Campbell et al. a security breach in a company leaking confidential information has significant negative implications on the respective stock price, displaying reduced market expectations regarding the company's future success [4]. A similar analysis for privacy breaches conducted by Acquisti et al. initially brought less conclusive results, but still indicates negative impacts on stock prices, eventually followed by a recovery [1]. With the importance of electronic mailing for the companies' success and the confidentiality of information sent via e-mail, the consideration of security aspects is a must for evaluating web-based e-mail services.

The criteria we used for our study to examine security aspects of web-based e-mail services are shown in table 3.

Table 3: Security related evaluation criteria for web-based e-mail services

No.	Security: Name and description
S.1	Virus protection: Existence and extent of a virus protection for incoming and outgoing e-mails
S.2	SSL-secured access: Capability to access the stored e-mail data via SSL-secured connection [20]
S.3	Data center operations: Provider of the used IT infrastructure services
S.4	Phys. access control*: Existence of a physical access control for the data center [2]
S.5	Data loss protection*: Existence and extent of a backup protection against data loss
S.6	Electronic signatures: Capability to use electronic signatures via browser-interface

Costs: Cost reductions are a frequently used argument for the outsourcing of IT-functions and services. Indeed, assigning the provision of e-mail services to an Application Service Provider must also convince companies from an economic perspective. To get a general overview of the costs that are charged for web-based e-mail services, we analyzed costs in a life-cycle oriented manner. Table 4 shows which criteria we used for evaluating the costs of web-based e-mail services.

Table 4: Criteria to evaluate costs of web-based e-mail services

No.	Cost: Name and description
C.1	Initial costs: Costs per user that are charged for setting up the service
C.2	Recurring costs: Monthly costs per user, which are charged for operating the service
C.3	Hotline costs: Costs that are generated by telephone support per minute

Trust: A trustworthy, successful and long-lasting cooperation with the Application Service Provider is advantageous for companies consuming the services because transaction costs, which occur for switching the provider, can only be eliminated this way. Criteria, which are suited to identify trustworthy, experienced and long-term successful service providers, are therefore part of the fifth and last evaluation category. As one source for criteria definition we used the findings presented by Tamm and Wünsche, who analyzed the influence factors of the information asymmetry on the web service market. They demonstrate that the overall confidence in the web service increases by an growing number of web service users [19].

Table 5 presents the single criteria we used for our study.

Table 5: Criteria to evaluate the trustworthiness of e-mail service providers

No.	Trust: Name and description
T.1	No. B2B-customers: A service provider's total number of served business customers
T.2	No. B2B-users: A service provider's total number of e-mail users in the B2B-area
T.3	No. employees: A service provider's total number of employees
T.4	Annual turnover: A service provider's turnover reached in the last year
T.5	Annual profit: A service provider's profit reached in the last year
T.6	Founding year: Year the company that provides the service was founded
T.7	Awards on: Number of prizes awarded for the e-mail service by the press
T.8	Company type: Legal form of the enterprise which provides the service

By defining these 34 criteria we created the basis to objectively evaluate the e-mail services delivered by Application Service Providers. In the next step, we defined the values each characteristic should realistically have in order to satisfy the needs of customers in the B2B environment. The resulting scaling for all evaluation criteria and the assignment of part-worth utilities were the basis for the creation of a questionnaire and for later calculation of total utilities for all services. To reach an acceptable granularity for the scaling and to reduce the complexity for creating and analyzing the questionnaires and their results at the same time, we differentiated between two to five values per characteristic and assigned appropriate part-worth utilities.

3.2 Considered Application Service Providers and e-mail services

To limit the number of examined services and to simplify their selection, we focussed our study on services delivered by service providers with an origin in the German-speaking market. In addition we also included other service providers, which had a branch in a German-speaking country to serve the local market. This limitation guarantees a comparable regulatory background for all assessed service providers and allowed us to exclude considering legal differences.

Starting from existing market overviews, magazine reviews and internet research we assembled a full list

of e-mail-services that were locally available. Among the respective service providers we found both, small specialized businesses serving local customers as well as large providers offering a wide spectrum of IT services for international markets. Table 6 gives an overview of the selected providers and their offered e-mail services.

Table 6: Service Provider and their offered e-mail-services

No.	Service Provider	Name of Service
1	1&1 Internet	1&1 Mail
2	1&1 Internet	Outlook Exchange
3	Centron	E-Mail-Classic Mail Domain
4	Centron	Exchange Hosting
5	COLT Telecom	Managed Business Email Std.
6	COLT Telecom	Managed Business Email Super
7	FPW	Swissmail Profess. Account
8	Freenet	Freenet Business @Mail
9	Freenet	Hosted Exchange One
10	goneo Internet	E-Mail Plus
11	Host Europe	Mail Basic
12	Lycos Europe	LYCOS Premium Mail
13	NA-NET	eMail Hosting
14	SYMPLASSON	Exchange Service
15	T-Online	E-Mail-Paket
16	Web.de	Web.de-Club

Within a first pre-selection we used a set of minimum requirements, which had to be fulfilled by e-mail services to become part of our study. One of these exclusion criteria was that the e-mail-service had to be offered in a standardized or partly standardized manner. In addition we excluded e-mail services, which could only be delivered in combination with other services. As a third aspect for pre-selection we decided to include only offers, which exhibited a minimum amount of seriousness: in addition to the service provider's postal address we expected a minimum amount of information about the e-mail service and its features to be available on the provider's website. Among the Application Service Providers active in the German-speaking market we finally selected 12 providers, which fulfilled these minimum requirements.

To completely conduct the utility analysis, we needed to classify all chosen e-mail services according to the defined evaluation criteria. Because none of the service providers had published all required information in the product description on the website, we used a standardized questionnaire to collect the necessary information. We sent our form to product managers and customer services of the providers named above. The observed response time differed

widely, starting from a few hours through to six weeks. We were able to collect complete information about ten of the services named above. We considered missing details, for instance regarding a company's profit or turnover, as missing transparency and therefore rated it with a part-worth utility of zero in the final utility analysis.

4. Analyzing the empirical data

4.1 Service characteristics

Initially we analyzed the collected information regarding similarities and differences of the e-mail-services, to get an overview of the situation in the market of e-mail services for companies. Table 7 presents the assessed characteristics for which all or most service providers made congruent statements.

Table 7: Similarities of analyzed e-mail services

No.	Characteristic	Value	Fraction
F.1	Inbox	Existent	100%
F.2	Outbox	Existent	100%
F.3	Drafts	Existent	100%
F.4	Address book	Existent	100%
F.6	Auto-reply	Configurable	90%
F.7	HTML-mailing	Possible	100%
Q.4	Free of advertisement	Yes	100%
S.2	SSL-secured access	Possible	90%
S.3	Data center operations	Own data	90%
S.4	Physical access	Yes	100%
T.5	Annual profit	Not answered	100%
T.8	Company type	GmbH (Ltd.)	100%
C.3	Hotline costs	None	90%

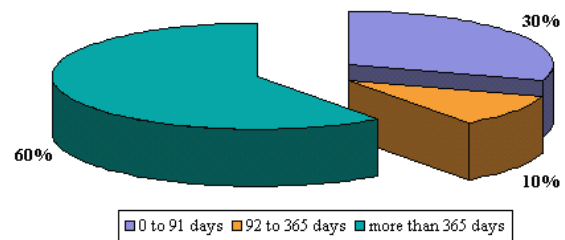
As can be seen, characteristics such as being free of advertisements, the existence of configurable auto-reply functionality or the possibility to access e-mail data via a SSL-secured connection are obviously understood as standards or minimum requirements by service providers. Likewise, the five exclusion criteria existence of inbox, outbox, drafts folder and address book and the physical access control to the data center are satisfied by all assessed e-mails providers. Moreover all providing companies are of the type GmbH (comparable to the British Ltd.). Due to limited publication duties connected to this company type, none of the asked providers made a statement about the company's annual profit.

Besides these similarities the studied services exhibit differences regarding many characteristics. A

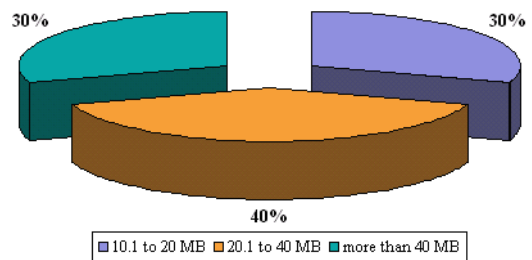
first functional difference we found for the number of used methods for spam identification, which was ranging from three to seven with 40% of the services using five different methods to identify spam mails. Even though this quantitative examination does not allow a conclusion about the effectiveness of spam identification, the high number of used methods shows, that identifying spam mails is attached some value by the service providers [7].

Some more functional differences we observed with the maximum storage time (a), the maximum size of sent and received e-mails (b) and the overall size of e-mail storage (c) as depicted in figure 1.

(a) Maximum storage time



(b) Maximum size of sent and received e-mails



(c) Overall storage size

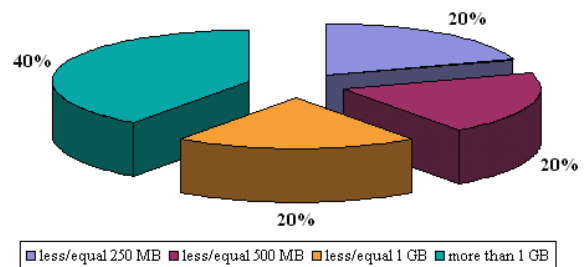


Fig. 1: Maximum storage time, size of sent and received e-mails and overall storage size exhibit the differences in functionality of studied services.

The maximum storage time, which is given as more than a year by more than half of the services, is limited to three months by three of the ten web-based services. Whether the latter fulfils the typical needs of customers in the B2B environment is questionable to say the

least. Also for the maximum size of sent and received e-mails some differences are obvious. However, all providers limit the size at 10.1 MB or more, which we think is acceptable for most applications. The same is to be observed with the overall size of storage, which amounts to 250 MB and more in most cases.

Only small differences were found with the capabilities to synchronize e-mail accounts and local e-mail clients and with the services' fax functionality. All examined e-mail services support POP3 and SMTP, eight out of ten services also allow to access e-mail data via IMAP. With 70%, the majority of assessed services does not provide any fax functionality and only two out of ten services allow both to send and receive facsimiles.

Figure 2 depicts the different, but high-level quality, of the studied services. According to our study, the majority of service providers contractually guarantee high availability of more than 99.5% on a yearly average and permanently provides technical support.

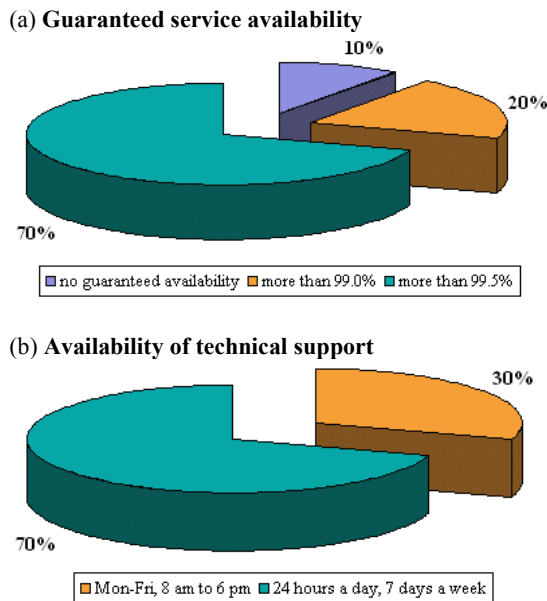


Fig. 2: Differences in services are also evident for quality aspects like guaranteed service availability and availability of support.

The protection against data loss was defined as exclusion criterion and is given for all services. However we observed differences with the frequency of backups, which has consequences for the maximum data loss period. While one service provider declared a possible data loss of four days in the worst case scenario, the maximum data loss period is limited to 48 hours for three services and to only 24 hours for another six services.

Other interesting aspects are the differences between the companies which provide the e-mail services. Among the service providers we found both small, specialized enterprises serving less than 2,500 business users as well as large enterprises, delivering their e-mail services to more than 100 other companies and reaching an annual turnover of more than 5 million €. The different statements about the number of employees working for the service providers, ranging from less than ten up to more than 200, underline the differences.

A final, but nonetheless important, difference we found was the cost of these web-based e-mail services. While nine of ten providers are not charging any costs for telephone support and initial costs are low level for most of the services, we observed very different charges per month and user, as depicted in figure 3.

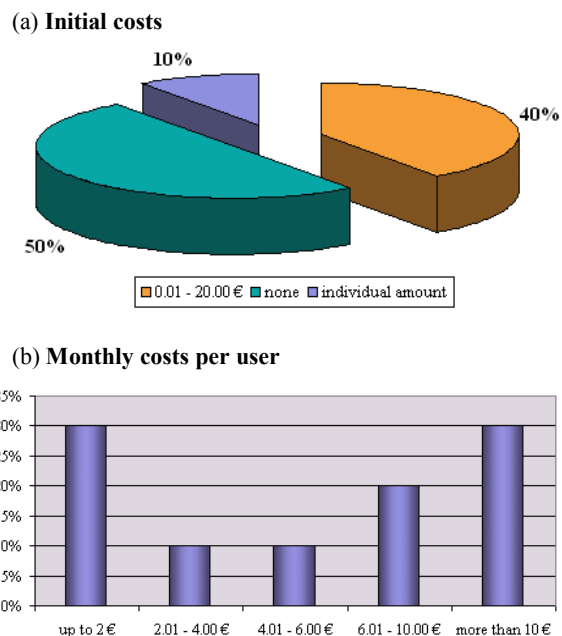


Fig. 3: Different one time costs and a wide spread of monthly costs accompany different service functionality and quality.

4.2 Utility analysis

After studying the services' characteristics we used a utility analysis to determine to which extent the currently available e-mail services fulfill the requirements in the B2B area and which of the studied services satisfies most of the needs that a potential customer has. To determine the overall utility of the services, we had to make additional assumptions about the weights of the different evaluation criteria and categories. Like the definition of criteria and part-worth utilities this weighting also tends to be very subjective. The only orientation that can be given is the re-

quirements of potential customers. Since customers would stress different aspects for selecting an appropriate web-based e-mail service, we defined five different scenarios to weigh the criteria and compared the results. To do so we used a simple two-step method. First we weighed the evaluation criteria within each utility category, stressing essential functionalities and characteristics and paying less attention to features, which are of less importance for business users due to infrequent use. Keeping these weights within the categories static, we then weighed the evaluation categories in different ways, using the five scenarios, which are given in table 8.

Table 8: Weighting factors per scenario and evaluation category

Category	Scenario	1. Balanced scenario	2. Functionality oriented scenario	3. Service oriented scenario	4. Security emphasized scenario	5. Cost sensitive scenario
Functionality		15%	30%	20%	10%	15%
Quality		20%	20%	30%	25%	15%
Security		20%	15%	15%	30%	15%
Trust		20%	20%	20%	25%	15%
Costs		25%	15%	15%	10%	40%
Sum		100%	100%	100%	100%	100%

All weights for categories are expressed by a percentage to which a category's criteria contribute to the overall utility of a service. Following the methodology of utility analysis the number of single criteria in a category is one of the points to consider when defining the weights. Another is the stressing of different evaluation aspects according to a customer's specific needs. For our first scenario we assumed all five evaluation aspects to be considered almost equally, shifting some weights from functionality to cost criteria. The latter reflects expectations, that services would display only small differences concerning their functionality and that costs as one of the major arguments to outsource e-mail services would be stressed by many potential customers. Thus, the Balanced Scenario was expected to come close to most companies' requirements. Since some potential customers would stress evaluation categories differently due to their individual outsourcing motivation or due to regulatory needs, we added another four scenarios, shifting the evaluation emphasis to functionality, service quality, security and cost. Analyzing the collected data according to these

five scenarios we could consider different requirement priorities of potential customers.

On this basis we calculated the utilities for each of the studied e-mail services as well as for each scenario. To assure that the data we collected from the service providers remained anonymous we used the letters A to J as placeholders for presenting the results instead of using the names of service providers and their e-mail services. Table 9 gives an overview of the resulting utilities and the services' rankings.

Table 9: Utilities and ranking of e-mail services for each scenario

E-mail service	1. Balanced scenario		2. Functionality oriented scenario		3. Service oriented scenario		4. Security emphasized scenario		5. Cost sensitive scenario	
	U	R	U	R	U	R	U	R	U	R
Service A	7.4	5	7.39	7	7.52	5	7.62	5	7.34	5
Service B	7.0	8	7.3	8	7.36	7	7.59	6	6.55	8
Service C	7.8	2	8.03	3	8.07	2	8.38	1	7.44	4
Service D	7.6	3	7.94	4	7.96	3	8.3	2	7.01	7
Service E	5.8	1	6.05	10	5.38	10	5.71	10	5.9	10
Service F	6.6	9	6.23	9	6.13	9	6.16	9	7.22	6
Service G	8.2	1	8.04	2	7.9	4	7.95	4	8.64	1
Service H	7.3	6	7.4	6	6.96	8	7.15	7	7.59	3
Service I	7.5	4	7.48	5	7.52	5	6.8	8	8.07	2
Service J	7.3	7	8.08	1	8.08	1	8.23	3	6.49	9

From the calculated utilities we can draw a number of conclusions. First, we see that some of the e-mail services reach a high overall utility no matter which scenario is looked at. Among these well-performing services we are services C and G, which ranked consistently in the first four despite the different focus of the five scenarios. In contrast we found other services like B, E and F to be constantly weak in comparison with other products. Regardless of the scenario, these services never reached a rank above six. For the remaining services, the utilities and, consequently, ranks strongly depend on the chosen scenario. The latter may mean, that some of the studied Application Service Providers focus with their e-mail services preliminarily on certain target groups, which allows them to completely fulfill the target group's needs and, at the same time, pay less attention to other aspects. Secondly, our results show, a single e-mail service which exhibits the highest utility for all five scenarios does not exist. This implies that the result of the selection of an optimal web-based e-mail service heavily depends on the individual requirements of a potential customer. None of the assessed services can

therefore be recommended as the best solution regardless of the customer's specific requirements. With respect to the focus we set in our five scenarios, the services C, G and I, respectively, are the best choice. However it may be possible, that different individual requirements will also result in a different ranking of utilities. Nonetheless this will most likely not lead to a recommendation of one of the services that are found to be weak in our five scenarios.

Furthermore, if we understand the calculated utilities as the degree to which the defined requirements are fulfilled, we can draw additional conclusions on the differences between business requirements and offered e-mail services from that. It turns out, the weakest e-mail services reach only between 50% to 65% of the highest possible utility of ten. In contrast, the services placed best in our utility analysis managed to fulfill between 80% and 90% and thus the vast majority of the maximum requirements. The reasons for the utility reductions are especially to be found in the evaluation category Trust, in which most of the service providers reached only a part-worth utility of six or less, even though a utility of up to ten was possible. In all other evaluation categories, at least some of the service providers managed to reach a part-worth utility of nine or even ten, which is reflected in the overall fulfilment of up to 90% of the maximum requirements.

5. Summary

This research on web-based e-mail services revealed different findings about services offered for the B2B area in the German-speaking market. Based on a few assumptions regarding requirements and the weighing of evaluation criteria, we found that none of the ten e-mail services observed can be recommended without considering the individual focus of the potential customers. All in all, we identified three different e-mail services, which reached the highest utility in one or more of the defined scenarios.

Moreover, we found that some of the services were categorically weak with a low utility, whereas others performed well in all of our scenarios. The utility of a third group of e-mail services fluctuated depending on the focus of the scenario, which may be caused by the provider's focus on a certain target group. In addition, the collected information shows that the studied e-mail services fulfill most, but not all of the defined requirements. Functional and qualitative characteristics of the services are on a level which is adequate for the B2B market. The same applies to the security aspects, which were part of our utility analysis. Since the majority of the service providers studied and active in

the market were identified as small or medium-sized companies, high expectations regarding the evaluation criteria embraced in the category Trust could not be met. Fundamentally, this weak point does not change the overall impression that the e-mail services ranked best with a fulfilment degree of 80% to 90% serve most of the defined requirements and in consequence are suitable for the use in the B2B environment without limitations.

Besides the studied characteristics, the observed service transparency and the response time for requests are further criteria to decide for or against a service provider. During our study we observed a low overall transparency and very different response times, both of which can be improved. We missed publicly available, detailed statements about the delivered services in many cases. Answering our questionnaire on average took three weeks. To reduce the existing information asymmetry it is still necessary that both, service transparency and time to respond to any kind of customer request will improve during the next years.

The question whether web-based e-mail services represent a serious alternative to in-house operating of e-mail solutions, can thus be answered in the affirmative, however with limitations. All services, which are ranked best in our study, can generally keep up with professional services. The costs charged for using the services range between less than 1 € and up to 12 € per month and user, which is acceptable in comparison with the TCO of \$10 for an internal e-mail solution, that was calculated by Gartner analysts. Web-based e-mail services are consequently seen as professional and cost-efficient alternative to in-house operating, especially for small and medium-sized companies which do not make unusual demands of their e-mail solution.

In contrast, for big companies that already operate their own professional IT-infrastructure for other IT-services, and which have to serve a huge number of end users, using the web-based e-mail services of an Application Service Provider has no significant advantages. Consequently, the outsourcing of e-mail services does not provide large benefits for those companies, if any at all. In this case, operating the e-mail services in-house seems to be preferable.

6. Further work

The B2B market for web-based services in general and for e-mail services in particular will experience significant growth during the coming years. It is expected that more companies will make use of products available on the market and that new service providers will enter the market, competing with the

existing ones. The stronger competition will lead to declining prices and a broader variety of products in the long term. At the same time it is expected that transparency regarding service characteristics will increase, in order to facilitate the acquisition of new customers. Whether service providers will manage to generate additional utility for their services to make outsourcing more attractive even for larger companies remains to be seen.

To trace the expected developments of the market we will have to check the results we found within a timeframe of one or two years. The utility analysis we used then should be extended and thus strengthened in its expressiveness. The criteria we used for evaluation could be extended for a more differentiated result. In addition it would be interesting to confirm the providers' information about the delivered e-mail services with practical tests. Whether the statements made by the service providers are correct, whether virus protection and spam identification really work effectively, whether the guaranteed service availability is observable and whether the support is able to respond successfully to problems can only be proven in practical tests. Such an extension of our methodology would add more real-life substance to our current results.

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