Eidgenössische Technische Hochschule Zürich
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Quality of Service for Application Service Providers

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Abstract: This paper presents a very recent survey of the worldwide Application Service Provider (ASP) market. A questionnaire was sent out to ASPs and received answers were evaluated. The focus of the survey and the evaluation was to investigate on how ASPs are currently using Quality of Service (QoS) mechanisms and how they plan to do it in the future. The goal was to see the chances of success IP QoS mechanisms do have with their potential users. The survey showed that many ASPs are employing QoS technologies like ATM but only a few are interested in IP-based QoS. The question of IP-based QoS seems to be not important for ASPs, they use different technology instead. The major problem ASPs themselves are currently facing is the economical slowdown.

1 Introduction

While the Internet has experienced an enormous growth during the last decade, this growth took place without major changes to the protocols its communications are based upon. The Internet is still based on the Internet Protocol (IP), which offers only a 'best effort' transport of data. This means that every data packet is forwarded towards its destination as best as possible but no guarantees regarding its arrival or the time of its arrival are given.

To improve this situation during recent years the introduction of Quality of Service (QoS) mechanisms into the Internet has been discussed. Network management could be done on a much finer scale and guarantees could be given regarding bandwidth, delay, jitter or other parameters of a connection in the Internet. While there are several competing QoS proposals

like Integrated Services (IntServ) and Differentiated Services (DiffServ), many doubt the usability of such approaches in general and instead advice to use over provisioning of the network to guarantee the timely delivery of every data packet. QoS supporters reply by pointing towards multimedia applications, which can not run reliably over the Internet, e.g., high quality TV on demand, or to the window of scarcity [1], indicating that there exist applications, which are just barely usable using the available sufficient but scarce resources.

This paper approaches the QoS discussion from a practical perspective. In this discussion it is important to see what a group of potential QoS users do and which mechanisms they employ to manage their network connections. Such a group exists in the form of Application Service Providers (ASPs). These companies give their customers remote access to applications, which would otherwise run locally at the customers' premises. Because the accessibility and reliability of these applications is of critical importance to the customers the QoS management offered by the network over which the applications are accessed also becomes very important. The goal of the worldwide survey on the ASP market presented in this paper is to overview offered services, employed QoS mechanisms, and service level agreements ASPs use to manage relations to customers. Of special interest is to show how ASPs provide services with sufficient quality and the relation between ASPs and IP QoS mechanisms.

The remainder of this paper is structured as follows. Section 2 gives a short overview over the ASP market and the current situation of QoS. Section 3 describes how the survey was carried out, while Section 4 evaluates the answers to the survey. Finally, a short summary and the conclusions drawn from the survey are given in Section 5.

2 State of the Art

When companies outsource their application provisioning to ASPs (cf. Section 2.1) they mostly want to save money and effort. However, since nowadays the success of their business relies heavily of these applications, the ASPs have to guarantee their accessibility and performance. In order to do this they have to employ QoS mechanisms (cf. Section 2.2).

2.1 ASPs

So far Application Service Providers have not been a major topic of research. The existing analysis and reports were mostly published by either ASP consortia or consulting firms. While [2] defines ASPs as someone who 'provides applications and all the IT infrastructure and support services necessary to deliver them to customers on a subscription basis', others (e.g., [14] and [10]) have a more complex view on the ASP business. While their exact views differ, all of them agree on the existence of a value chain, where several different providers work together to provide the overall service to the end users. This includes the provision of network services (network providers), the provision of computing services to run applications or to store data on (infrastructure providers), the provision of applications (application providers) and finally the integration of all these services and their common provision to the customer (solution providers). The solution providers are commonly named ASPs. Their exact business models differ, for instance some of them also provide network services themselves, while others rely on business partners to do this.

However, according to a Gartner Group study [7] only 40% of the ASP companies founded prior to 2001 will survive. Most companies were supposed to fail in the middle of 2002 because of undeveloped business models, wrong partnerships, difficulties in implementing the ASP model, or the consolidation of the ASP market. This is in accordance with another Gartner Group study [8] in which a hype cycle for emerging technologies was presented. According to this study the ASP business had reached its 'peak of inflated expectations' in 2000 and was heading for the 'trough of disillusionment', because the ASP idea did not live up to the over inflated expectations.

2.2 QoS

While the overall QoS offered by ASPs to their customers depends on the QoS of the different services introduced above, this paper focuses on QoS of network services. It does not consider QoS of applications themselves at all, as this is more a problem of software engineering. In order to provide QoS at the infrastructure level, well understood mechanisms like load balancing already exist. The survey evaluated the use of some of these mechanisms, but did

not investigate more specialized possibilities as parallel computing, as this is again a problem of software engineering.

Regarding the quality of network services many new mechanisms have been proposed during the last decade, which can generally be classified into two groups, depending whether they are building on IP or not. The mechanisms not building on IP include architectures like Asynchronous Transfer Mode (ATM), Frame Relay (FR) or Fiber Distributed Data Interfaces (FDDI). All of these mechanisms have in common, that they support virtual end-to-end connections between sender and receiver and can guarantee certain QoS like available bandwidth for these connections. It is still possible to run IP over the virtual connections, though this means losing many advantages of the underlying network technology.

On the other hand there are QoS mechanisms building on or extending IP, including Integrated Services (IntServ) [4], Differentiated Services (DiffServ) [3] and Multi Protocol Label Switching (MPLS) [11]. The basic idea of IntServ is to allocate network resources to each data flow in the Internet. This results in the need for a signaling protocol like the Resource Reservation Protocol (RSVP) [5] to reserve the resources along the path the flow travels. The drawback of IntServ is that it is necessary to maintain flow status information in each node along the path, which leads to an enormous management overhead. Since this might lead to a scalability problem DiffServ was proposed. DiffServ does not manage resources per flow but aggregates flows into classes, thereby reducing the management overhead. However, currently there is no accepted solution on how to provide a guaranteed end-to-end QoS using the building blocks that DiffServ offers [9].

In contrast to IntServ and DiffServ MPLS does not provide any QoS guarantees itself. Instead it is a mechanism which forwards packets through the Internet depending on labels attached to them, not IP-addresses. This way of forwarding is faster, but the labels have to be set up before the communication takes place. While MPLS itself has no QoS support it can be used to do better traffic engineering or even to support DiffServ.

While the problem of combining services is mainly a software engineering problem, a solution provider and its customers must agree on which level of QoS the supplied service

will be delivered, how the actual service usage and quality will be measured, and how the service will be paid for. Of special importance is the definition of actions to take when the service is not provided with the QoS agreed upon. All these agreements are compiled in a contract called service level agreement (SLA).

3 Questionnaire

The questionnaire used to carry out the survey contained 40 questions grouped as follows:

1. Business structure
2. Applications and operating systems
3. Network
4. QoS
5. Service Level Agreements
6. Security
7. Current problems

While the questionnaire also contained questions not directly related to the provision of QoS, all parts contained at least some related questions. This paper focuses on the answers to these questions. The complete study, including the questionnaire itself, is available as [6].

The questionnaire was sent to 960 companies, which offered ASP services. The mail contained a cover letter, a cover sheet with explanations on how to fill out the questionnaire, the questionnaire itself and an international return envelope free of charge. Companies were asked to fill in the questionnaire and return it using the return envelope. For their convenience an online web-based version of the questionnaire was also available. In order to create an on-line version, an application [12] was used to generate automatically HTML forms and to store filled in questionnaires in a MySql database, hosted on a server at ETH Zurich. Addresses of ASPs were gathered from the Web. Postal addresses were listed partly, otherwise only the company's name was quoted and the corresponding address was traced by their homepage.

The largest part of the questionnaires (71%) was sent to companies in the United States and Canada, 21% to companies in Europe, and 8% to companies in other continents.

Altogether 50 answers were received. This corresponds to a rate of 5.2%. Several letters (7.6%) did not reach their recipients because of incorrect postal addresses given on web

pages. As Figure 3.1 shows, most responses came from companies operating in Europe, although most of the questioned companies addressed reside in the United States or Canada.

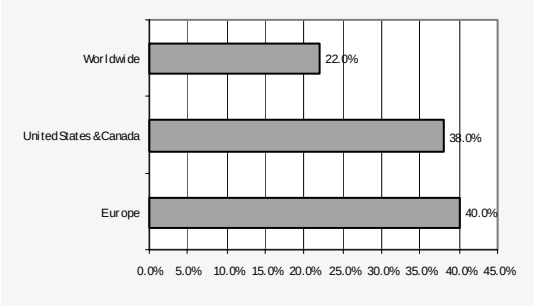

Figure 3.1: Origin of answers

4 Evaluation

To evaluate the set of data obtained, the business structure of ASPs is shown, followed by the investigation of QoS provided on a lower, the IP, and the server level. Afterwards, service contracts between ASPs and customers are described and problems of ASPs are discussed.

4.1 Business Structure

In order to judge the QoS related answers to the questionnaires correctly it is necessary to first take a closer look at who gave these answers. The technical decisions taken were often influenced by the needs of the market. Therefore, before evaluating the answers a closer look at the general ASP market shall be taken. The ASP market is still in its infancy state (cf. Figure 4.1). Most of the ASPs answered the question ‘For how long they have been operative in the ASP business’ with ‘Between 1 and 2 years’. According to the hype cycle, most companies were founded in the phase of inflated expectations and today they are in the descending phase of the hype cycle.

Figure 4.2 shows in which business segments the ASPs have been operative before starting the ASP business. ISPs could be the key players in the ASP market. Since they are faced with a narrowing margin brought on by fierce competition, they could expand their services beyond the providing of bandwidth and connectivity by adding remote hosting services such as outsourcing applications in order to increase profitability. These services would give ISPs

an advantage over other ISPs. It is also advantageous that ISPs already have the expertise in offering bandwidth and connectivity to their customers.

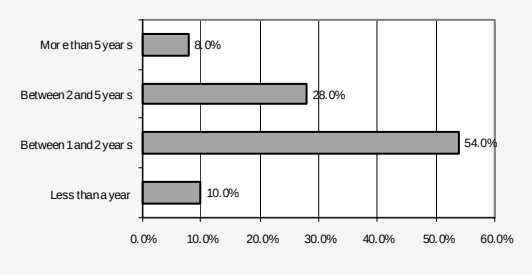

Figure 4.1: Duration of operation as ASP

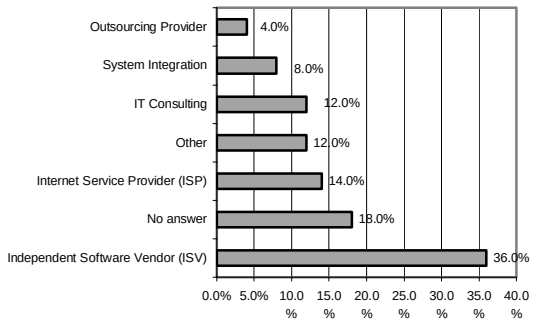

Figure 4.2: Entrants into the ASP market

However, as shown in Figure 4.2, it appears that most companies, who enter the ASP market are Independent Software Vendors (ISVs). ISVs have the benefit that they own and produce the applications they provide. They can modify their applications to fit their customers' needs at will. Further on, ISVs already control the relationship with the end users of their software. At last, the ASP model may represent a threat to ISVs in the extent that the ASP model opens the door for other companies to take away control of their customer relationships. Therefore, ISVs have to enter the ASP market in order to maintain their market share.

Another goal of the survey was to investigate what the core competencies of the ASPs are. The survey asked for five different business sectors: ‘How much do you depend on business partners?’ Choices included ‘not at all’ (corresponding to value 1), ‘somewhat’ (value 2), or ‘completely’ (value 3) per business sector. These business sectors and the mean opinion score (MOS) calculated out of answers are shown in Table 4.1 below.

Dependency Sector	MOS	Dependency Sector	MOS
Network	2.24	Applications	1.96
Data center	1.82	Security	1.72
Support	1.57		

Table 4.1: Core competencies

ASPs have few business partners in the sectors support and security. Security is a critical aspect for many ASPs and for their customers. An ASP must guarantee privacy and security of customers' data. This purpose requires a good security policy. It may be beneficial for ASPs to hire third-party security firms to provide an evaluation and assessment of the security relevant components of their system, but the security enforcement can only happen on the premises of the ASPs and their business partners, e.g., data centers. Customer support is also a very important component of the ASP model. Much of the ASP value proposition is based on the reduction of internal IT requirements. To achieve that goal, the ASP must take the responsibility for those services.

In case of management and maintenance of the data center and development of applications, ASPs have, compared to the other sectors, more business partners. This fact could be related to time-to-market issues or capital requirements. There are different specialized service providers such as application infrastructure providers (AIPs) to whom ASP can outsource data center services. Figure 4.2 showed that most of entrants into the ASP market are ISVs. However, their customers will not only need software developed by ASPs themselves, but also rely on standard or specialized applications from other companies. Therefore, it is not surprising that on average most ASPs rely on other companies in order to supply all the applications their customers require.

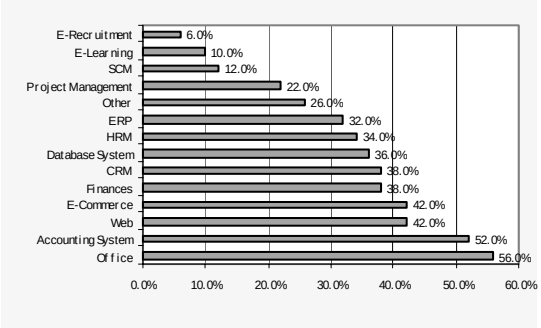

Figure 4.3: Applications

Figure 4.3 shows applications offered by the ASPs. Most of these applications are office and accounting system applications. A reason for that is, besides the law of supply and demand, that these applications are well known and standardized. A basic idea of the ASP model is the ‘one-to-many’ concept. This means an ASP wants to offer the same application to as many

customers as possible. Thus, standardized applications such as office and accounting applications fit well into the ASP model. Opposed to that are complex and specialized applications such as Enterprise Resource Management (ERP), Project Management, or Supply Chain Management (SCM) applications, which require a higher degree of customization and thus fit worse into the ASP model, but are produced by ASPs themselves.

ASPs rely most on business partners in the network sector. Offering bandwidth and connectivity to their customers is not a core competence of ASPs. They rely on business partners such as network service providers or Internet service providers (ISPs). As it was shown in Figure 4.2 only 14% of the ASPs were operating as ISP before. Since the requirements on the network connection between ASPs and their customers are high, it is unlikely that many more ASPs will enter this market; instead they will buy the needed network services from specialized companies.

4.2 Non-IP QoS

In order to provide QoS, QoS requirements must first be evaluated. Figure 4.4 shows the average bandwidth that a single user needs to access applications provided by the ASP. In almost 80% of the cases no more than 128 kbps bandwidth are required. This low value implies that the provided applications have none or little multimedia effects.

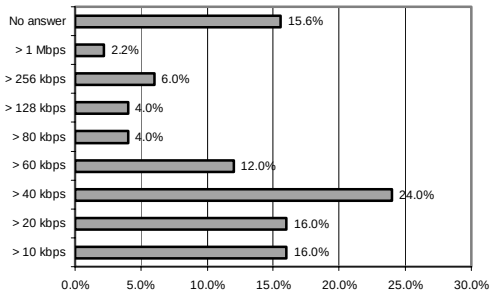

Figure 4.4: Bandwidth requirements

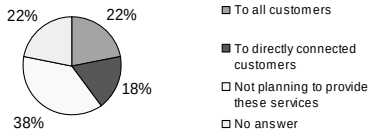

Figure 4.5: Real-time applications

On the other hand, driving factors for the deployment of QoS mechanisms are real-time applications, because they need strict guarantees from networks. Examples for real-time applications are IP-telephony, video-conferencing or video-on-demand. Therefore, ASPs were

asked, whether they plan to provide real-time applications. As shown in Figure 4.5 currently 40% of ASPs are planning to provide real-time applications.

One possibility to guarantee the necessary availability of the required bandwidth is to use networks other than the Internet, e.g., ATM. As the survey shows this technique is used by 62% of the ASPs. Figure 4.6 determines the use of specific network technologies, applied in order to create connections between ASPs and their customers. While ATM, FDDI, and Frame Relay are used to build networks, they offer the possibility to establish virtual connections between two sites. When establishing virtual connections, different QoS requirements, such as bandwidth, can be specified.

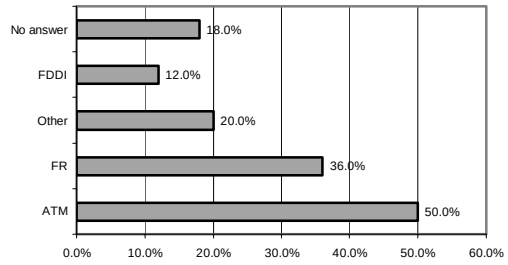

Figure 4.6: Use of network technologies

ATM networks are prevalent in wide area networks and offer well-engineered QoS mechanisms. These are reasons to use this network technology by most ASPs (50%). A benefit for ATM is the advent of xDSL technologies, since these technologies enable to run ATM over xDSL, thus, offering the capability to use ATM as an access technology.

All these technologies have in common, that they work independently of IP. It is possible to combine them with IP, though this offers no benefits except the compatibility with IP dependent applications. In the survey 49 of 50 ASPs stated that they were using the TCP/IP protocol stack to provide their service.

4.3 QoS based on IP

Most of the 20% of ASPs using other network technologies than the ones presented so far (cf. Figure 4.6), stated that they were using the Internet. The survey determined what kind of QoS

mechanisms these ASPs apply in order to provide their services to their customers. Therefore, the questionnaire listed the following six IP QoS mechanisms:

- The Resource Reservation Protocol (RSVP)
- Classification of network traffic, whereby each traffic class receives a particular forwarding treatment (DiffServ approach)
- The Multi-Protocol Label Switching architecture
- Active queue management mechanisms
- Controlling the TCP rate at network edges
- Over provisioning of the network

ASPs had the possibility to classify each QoS mechanism in the following different ways:

- We are using this mechanism
- We are planning to use this mechanism
- We are not planning to use this mechanism

The classifications done by ASPs are shown in Table 4.2 below.

IP QoS mechanism	Using	Plan to use	Will not use
IntServ	5	2	6
DiffServ	12	2	3
MPLS	7	0	6
Active Queue Management	5	2	6
Controlling the TCP rate	10	3	4
Over Provisioning	7	1	6

Table 4.2: Use of IP QoS mechanisms

On average more than 70% of ASPs did not classify a specific QoS mechanism. This rate corresponds to the percentage of ASPs, who are already using QoS technologies not being based on IP, although there are some exceptions. Five ASPs even claimed to already be using

all of the mechanisms mentioned, which seems highly unlikely if not impossible, since some of them are barely deployed at all.

Most ASPs do not seem to plan using IP QoS mechanisms. Only the DiffServ approach and controlling the TCP rate seem to have significant acceptance. Surprisingly, as Figure 4.7 shows almost half of the respondents believe that a standard for IP QoS will win recognition in less than three years.

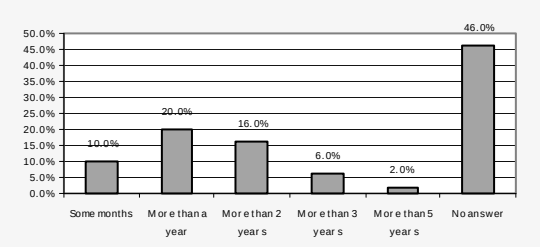

Figure 4.7: How long will it take until a standard for IP QoS will win recognition

4.4 QoS at Server Level

Another important task for ASPs is to provide the required quality at the server level. If servers fail to handle customers' requests, an overall QoS cannot be delivered.

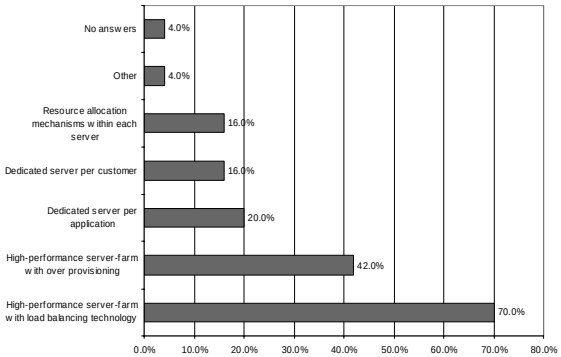

Figure 4.8: QoS at server level

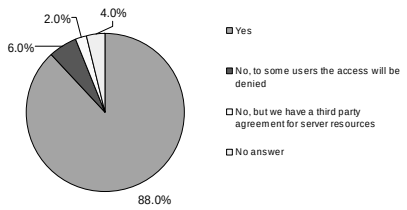

Figure 4.9: Servers' ability to handle requests at times of peak load

As Figure 4.8 shows, 70% of ASPs use load-balancing technology. Load balancing algorithms distribute evenly customers' requests across available server resources. It balances server loads to enhance performance and prevents any server from being overburdened. Load balancing technology also offers the possibility to separate the requests into several classes, each of them with different performance levels. In case of peak loads, requests with a higher

priority are processed first. The priority of requests could be based on different parameters such as the user, the requested application, or the specified service level.

There is one way to meet and exceed every demand, and that is to throw an unlimited amount of hardware at it. This solution of over-provision implies high costs and servers have to be upgraded according to the increase of customers. Almost half of ASPs use over-provisioned servers. Figure 4.9 answers the question ‘In case of peak loads are your servers able to meet all user requests?’ Almost all ASPs claim that their servers will handle all user requests, although not all ASPs are using over-provisioned servers. Few ASPs (6%) are aware that their servers will not be able to handle all user requests in case of peak loads. In order to keep a certain level of Quality of Service for the current users, the access to new users will be denied.

An interesting solution for delivering the services in case of peak loads with the required quality is to use load balancing technology not only with the own servers, but including servers of a third party. Computing Utility Providers offer individual resources on a utility model. The most prevalent form is the storage service provider. It is also possible to use other server resources from a third party, such as memory or CPU-time.

4.5 Service Level Agreements

Service level agreements are an important instrument of solution providers, as they enable them to specify the level of QoS to be provided to their customers. Service level agreements should offer customized options for individual customer’s requirements allowing them to create an SLA that best suits their business needs.

Figure 4.10 determines the kind of SLAs ASPs provide. 44% offer modular SLAs, which can be adapted according to customer's demands in the extent of available modules. 10% create a new SLA from scratch to meet completely customer's demand. Remaining respondents (44%) offer a standard SLA that cannot be adapted to customers' demand.

Figure 4.11 shows for which segments an ASP applies SLAs. Least guarantees are made for data security, although this is of critical importance for customers. To increase customers trust more SLAs including data security guarantees should be applied. Most guarantees are made

for the support. Utilizing ASPs means not only to outsource applications, but also to reduce IT staff and loose IT know-how. ASPs must provide strong support for their customers.

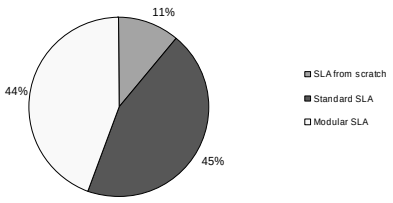

Figure 4.10: SLA types

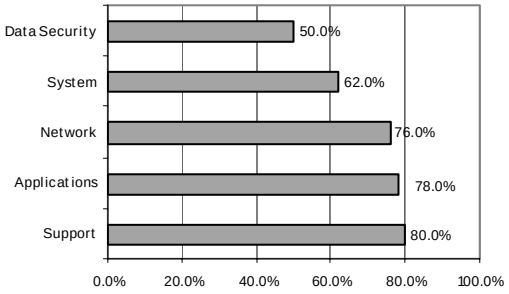

Figure 4.11: SLA contents

The quality and availability of offered services depends fundamentally on the quality of the applications themselves, on the performance of the network, and of the system on which applications run. SLAs should include specifications that characterize an overall performance of the applications, network, and system. This is done by most of the ASPs.

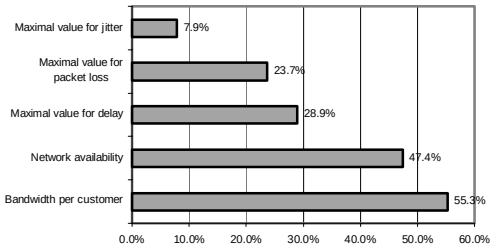

Figure 4.12: Parameters of the network SLA

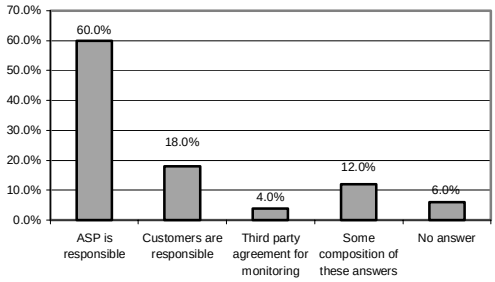

Figure 4.13: Monitoring

Figure 4.12 shows which parameters of the network SLA are guaranteed. In this figure 100% is the amount of respondents, which are applying a network SLA. If a service level agreement between an ASP and a customer exists, the service performance has to be monitored, so that customers can conclude whether the service performance meets their expectations. Most of ASPs are responsible for verifying if the service guarantee has been accomplished (cf. Figure 4.13). In some cases customers have to look for their own, whether service performance is equivalent to specifications in the SLA.

Of interest is Figure 4.14 showing that in the case where ASPs do perform the monitoring of service performance, only 50% of them give customers the possibility to access online the monitoring information. In the other cases, customers probably will receive a report of the monitoring results in specified time slices. Thus, customers must trust ASPs that they will not fudge monitoring results.

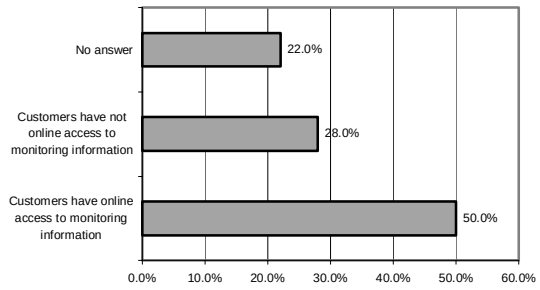

Figure 4.14: Access to monitoring information

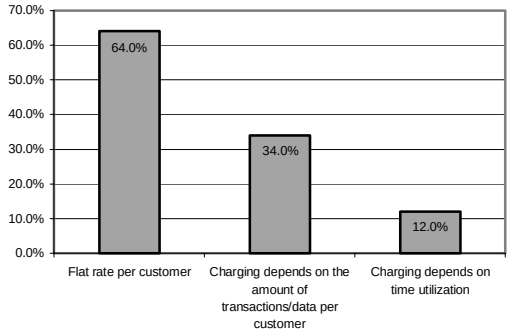

Figure 4.15: Charging methods

Figure 4.15 shows how ASPs charge the customers for the usage of their services. Most ASPs are not using benefits of the ASP model, such as the facility to charge customers depending on the amount of transactions/data per customer or depending on time utilization. Most apply a flat rate per customer. This could be sourced on customers' demand for predictable costs or on the complexity of usage-based charging mechanisms. However, a prerequisite for applying a usage-based charging scheme is that ASPs are not themselves owners and producers of applications, and that software vendors also offer charging schemes, which allow ASPs to make profit. As long as software products are licensed per user and not per usage, this is not possible. Usage-based charging mechanisms would allow customers wanting to use a certain application rarely to do so at a reasonable cost. The ASP could provide the application to several customers, thus gaining new customers.

Another point that should be part of a SLA is to straighten out what happens in case the ASP is not able to provide its services with the quality agreed upon. Figure 4.16 shows different ways how ASPs handle this task. While in most cases there is a monetary reimbursement, only 4.4% of the ASPs offer to take on any cost incurred by lacking QoS. In most cases there is a limit to the reimbursement, e.g., up to the amount of charges the customer would

normally pay. Since lacking QoS can also mean the total failure of the service, costs incurred by the ASP not delivering its services can be much higher and can even lead to bankruptcies. Figure 4.17 shows the average SLA contract period. Since the ASP market is novel and nascent, both customers and ASP must be able to react quickly to changes. Therefore, contracts are short-lived.

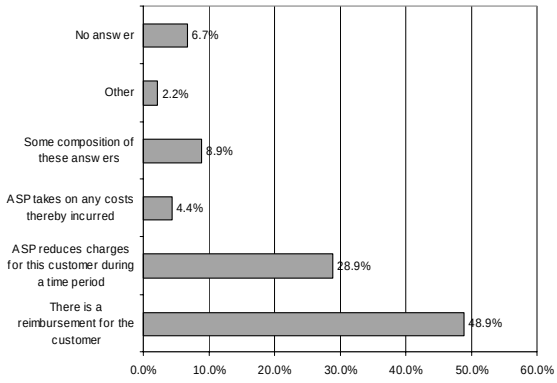

Figure 4.16: Not meeting the SLA

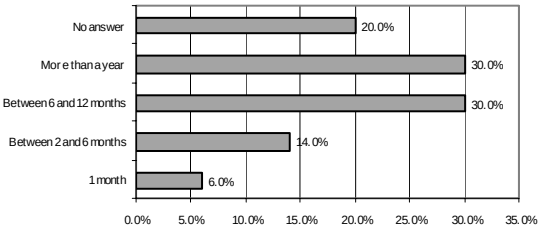

Figure 4.17: SLA contract period

4.6 ASP Market Problems

The last question of the questionnaire gave ASPs the possibility to rate the severance of seven problems which hinder the successful development of the ASP market, in order to investigate the importance of missing QoS standards in relation to other problems. The ASPs could classify the problems as critical (corresponding to value 4), major (value 3), small (value 2) or no problem at all (value 1). Again, the mean opinion score (MOS) was calculated from the answers as shown in Table 4.3.

		Potential Problem	MOS
Current economic slowdown	2.54	Customization of applications	1.94
Customers' confidence	2.31	No Standard for QoS	1.82
Integration with other applications	2.21	Over dependence on ISVs	1.8
Network Availability	2		

Table 4.3: Current problems

Since ASPs where operating as independent software vendors before they became to be an ASP it is no surprise that a large dependence on software vendors is almost no problem at all and the customization of applications is only a small problem. More difficult is the integration with other applications. Many customers will not want to entrust all their computing needs to a single service provider but will still rely on their applications working together. ASPs are confronted with the problem of having to create new interfaces to applications running at customers' premises or even at other ASPs.

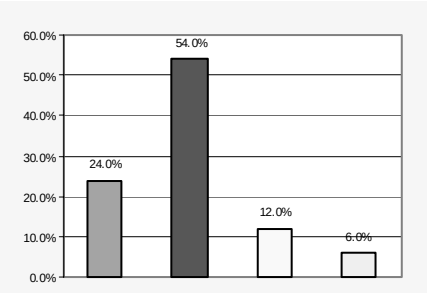

Figure 4.18: Network availability

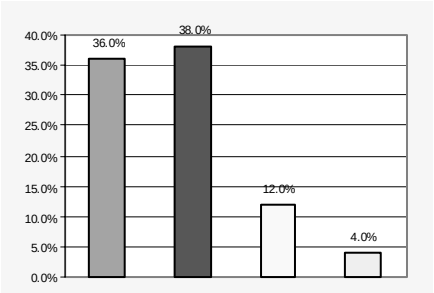

Figure 4.19: No standard for QoS

Quite surprisingly, network availability is only seen as a small problem. However, since more than 60% of ASPs have direct connections to their customers (cf. Section 4.2), this can not be a large problem (cf. Figure 4.18 indicating from 'no problem' on the left side to 'critical problem' on the right side). Having this in mind it is also not surprising at all that the lack of QoS standards is seen as an even smaller problem as shown in Figure 4.19. Many ASPs are already using QoS standards, just not standards based on IP. One of the largest problems ASPs are currently facing seems to be that customers have no confidence in the availability of services and security for which there could be several reasons:

- Since the ASP market is still in its infancy state, customers are reluctant to serve as test companies while these new entities experiment with their business models to address challenges in this nascent market.
- According to a Gartner Group study [7] that only 40% of the ASP companies founded prior to 2001 will survive, potential customers could also be reluctant to outsource their applications to companies that may not be in business long enough to fulfill their contractual obligations.

- According to [13] the most important reason for the customers to choose an ASP is that the ASP should be industry accredited.
- Everyone in IT has used the Internet and is well aware of the Quality of Service received, it is not jokingly referred to as the 'World Wide Wait' for no good reason.
- Messages appearing with constant frequency about hacking/cracking attacks or about new viruses do not increase the confidence of the customers.

According to the ASPs the problem, which hinders their development the most, is the current economic slowdown as also shown in Figure 4.20.

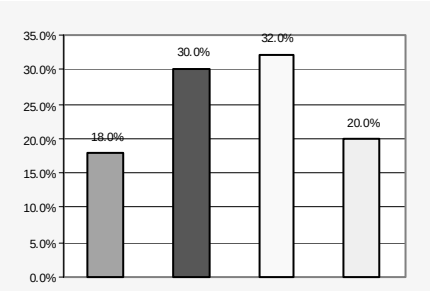

Figure 4.20: Current economic slowdown

However, while the economic slowdown surely will lead to some companies spending less money on new ideas like the use of ASPs, it might also lead to other companies outsourcing their complete application provisioning to ASPs in order to cut their own costs. It might very well be the case that ASPs are not that much affected by the general economic slowdown but more by arrival of the hype cycle's 'trough of disillusionment' as presented in Section 2.1. It seems very likely that the ASP market is currently in a phase of adjustment, where the overoptimistic initial expectations vanish. Many ASPs will probably not survive this phase as an independent company.

The survey offered also the possibility to extend the list with further problems. Although this option has not been used a lot, the following problems where listed:

- Customers do not want to outsource sensitive information
- Costs of communication lines
- Customers do not know or understand the ASP model

- Internal IT department is reluctant to outsource IT
- Lack of acceptance for IT services over Web
- Bad reputation of 1st wave ASPs

It is interesting to note, that most of these problems also fall under the 'lack of customers' confidence' problem.

5 Conclusions

This paper presented a survey of the ASP market carried out in the beginning of 2002, in order to investigate the use of QoS mechanisms by ASPs and their general view on QoS.

While the ASP market is growing it seems clear from those answers received that the market is currently in a difficult phase, where overoptimistic expectations make room for disillusionment. Still, the lack of QoS standards does not seem to be one of the problems having a major influence. Most ASPs have no real interest in IP QoS standards like IntServ or DiffServ because they are already using well established QoS technologies not based on IP, e.g., ATM, Frame Relay or FDDI. For an IP-based solution, which will be able to gain a larger share of the market, it must at least be as powerful and easy to use. However, while IP QoS is currently not a topic in the ASP market, quite a lot of ASPs express the opinion that an IP QoS standard will win recognition over the next three years. If this is really the case, ASPs and their customers might want to exchange their currently employed QoS technologies against IP based ones, in order to do all their communications over one network, the Internet.

It would be interesting to see, whether those ASPs views are shared by their customers. However, the methods for carrying out such a survey independently would be very complex, since there is no known group of ASP customers.

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