Second year Evaluation and Assessment Report (D13)

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1 Introduction

In this report we discuss the progress of the TAPAS project during the second project year from April 2003 to March 2004. The second year was characterised by highly interdependent and hence interactive research and development activities. In order to reflect these relationships we choose to present the main decisions and results of the second TAPAS year by discussing a typical TAPAS application scenario and it's technical implications.

The scenario provides a realistic background for discussions as well as for the evaluations to come. Hence it is quite important to choose an appropriate scenario from industrial-relevant experiences. The chosen business scenario is discussed in section 2.

The discussions about the technical solutions of TAPAS for providing trust and QoS in such a scenario are reflected in section 3, followed by a short outlook in section 4.

Section 5 summarises the remarks made by IAB members at the TAPAS IAB Meeting held in London on 2nd February, 2004.

The last section outlines the main topics for the demonstration of the project in Dortmund in September 2004.

2 Business Scenario

2.1 B2B auction scenario

In order to evaluate the methods, tools and techniques developed by TAPAS we decided to construct a real-world auction scenario, because auctions cause typical trust and QoS problems. On the other hand the scenario should allow to evaluate the fulfilment of the economic criteria as well. Hence it was quite clear that a fitting scenario should belong to the field of small and medium enterprises (SME), whose market position shall be improved by the TAPAS results.

Hence adesso explored existing B2B auction scenarios in different industries in Europe, especially in Germany. It quickly turned out that auctions are quite often used as the last step in procurement processes, especially in manufacturing. Car manufacturers such as Daimler Chrysler AG use auctions to bring down the prices for their supplies. In this solution, suppliers will offer goods like wheels or other parts for cars, hoping to achieve the best price for their goods. In each bidding round the price is decreased, so that typically the lowest bid will win. This is obviously beneficial for the auctioneer, especially in case of Daimler Chrysler, fostered by the fact that such large companies will buy lots of goods and therefore have a strong market position.

On the other hand, one will find as well auctions run by smaller enterprises. Swiss-based Schindler Group is a manufacturer of elevators and escalators. The company uses an auction application to buy goods for their production. However, due to the complex nature of technical goods the auction is again only the last step in a complex procurement process. It must be noted, that quality assurance and examination of technical details is realised outside the auction application.

Starting from these observations we examined the existing scenarios in order to learn more about the procurement auction details. Typically B2B procurement auctions are sealed-bid reverse auctions that are carried out in a short timeframe of a couple of hours. Suppliers will not be able to see the bids of their competitors, though they will be informed about the lowest bid of each round. The auctioneer, however, will typically determine the winner either automatically or manually. The latter variant is used to incorporate non-technical criteria such as long business relationships.

The role assignment in the auction is static and goes back to the business relation. While C2C auction platforms like eBay allow registered users to have both roles, seller and buyer, in different auctions, procurement auctions constraint participants to have one fixed role only. It can be observed, that the relationship between the auctioneer and the bidder is quite unbalanced, because in this scenario the auctioneer has a very strong position.

In section 2.2 we focus on the participants and highlight the main goals and use cases for each, while in section 2.3 we focus on the resulting relationships between the parties.

2.2 Participants in the auction scenario

Figure 1 shows the different parties and the SLAs governing their relationships as an abstraction of the existing B2B auction solutions. Due to the fact that existing companies differ from each other in the way they run their business processes this abstraction may need to be modified when trying to adopt it to other real-world scenarios. For instance, usage of an external service might as well lead to a relationship between the auctioneer and the service provider instead of the relationship between the auction application owner and the service provider.

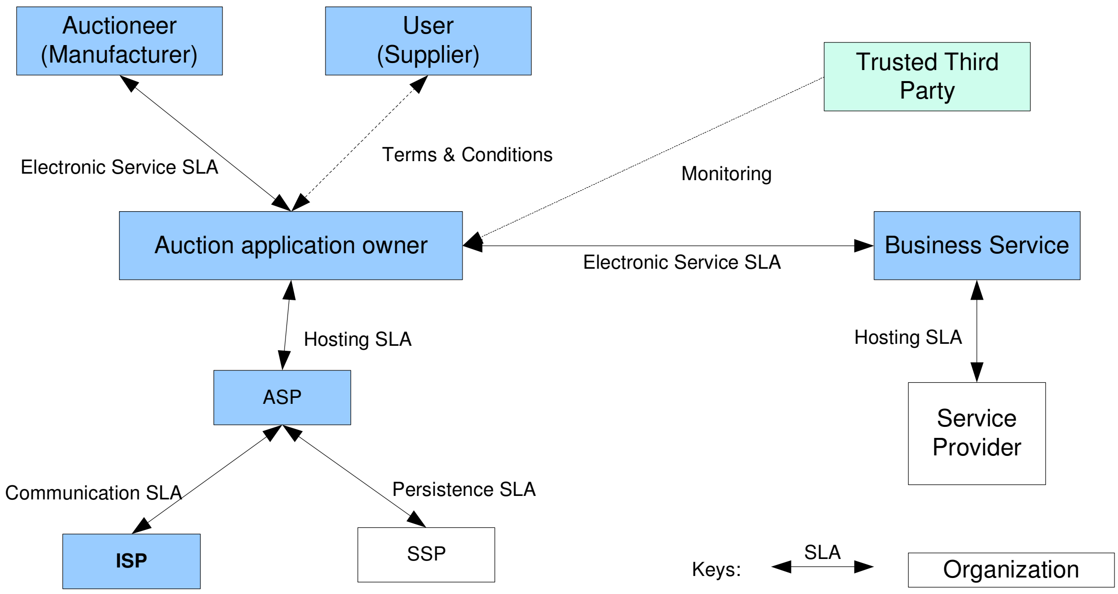

Figure 1

Starting with the auctioneer we can observe that he intends to obtain the required supplies, e.g. car seats, at the lowest possible price and therefore uses an auction application. In case of large companies such as Daimler Chrysler there will be parallel auctions for different parts, involving different suppliers. Typically a representative of the auctioneer has to prepare the auction by selecting and inviting the bidders and specifying the auction details such as timeframe and detailed auction type. At the predefined start date the auction will be started automatically, if bidders confirmed their attendance. During the auction the auctioneer can monitor the bids in each round. Finally, after the last round, the auctioneer is informed about the end of the auction and can choose the winner. This does not seem to be a fair selection for the bidders, however, it should be noted, that the auctioneer has a strong economical position and will therefore be able to abandon the automatic selection. Hence, trust concerns will arrise among the bidders.

Bidders in the auctions are the main user group of such an application. In this scenario bidders are competing suppliers of goods. Though a bidder is interested in winning the auction and finalising the deal, it must be noted that bidders are of course interested in achieving good prices for the goods. Due to the fact that suppliers in a B2B scenario might not have a long-term relationship, the economic situation of certain suppliers will be checked by the auctioneer. Thereby the auctioneer can avoid problems with bankrupt suppliers. However, a supplier is in a weak position compared to the auctioneer. He can accept an invitation to an auction and place a bid during the auction rounds. Typically, the handling of delivery, payment etc. is supported by dedicated applications and not included in the auction application itself.

The trusted third party (TTP) acts as a neutral arbitration authority to monitor the fulfilment of contracts. Due to it's supervision and escalation tasks it will foster the degree of trust between auctioneer, bidders and auction application owner. This is achieved by a precise monitoring of the fulfilment of the SLA between auctioneer and auction application owner, thereby increasing their mutual trust degree. Furthermore, the TTP is intended to supervise, if bidders and auctioneer behave as stated in their contracts, e.g. checking, if the lowest bidder wins a round. In cases of violations the TTP escalates or imposes sanctions or penalties. Though the TTP is usually paid by the auctioneer, it will be used as a sales argument as it increases the quality of the auction service.

It must be noted that the TTP is a rather new role. In today's industrial scenarios a permanent supervision is quite unusual, though certain companies and institutions such as TÜV in Germany offer quality approval services based on discrete approvals. Nevertheless it seems reasonable to define such a role because the service it offers is beneficial to all parties.

The auction application owner acts as an agent for the auctioneer, unburdening the auctioneer from lots of administrative and technical tasks. Furthermore, the auction application owner will run the application and care for enhancements etc. He is an expert in organising auctions and offers services to various clients, re-using the application and integrated business services. This party does not directly participate in carrying out a single auction. In order to utilise technical infrastructure without employing dedicated technical staff the application owner will cooperate with an ASP.

A business service provides services such as credit rating or billing. Service users can gain information without having to provide a complete infrastructure. Furthermore, the implementation details are encapsulated and hidden, so that usage will rely on standardised interfaces. The quality of the service can be fostered by again using a TAPAS platform for the implementation of the service. On the other hand, the application owner will monitor the service at the interface as well. The business service provider will rely on further service providers, who are not discussed here.

The ASP runs the application for the application owner and cares for technical infrastructure such as servers and connectivity as well as for operation and maintenance. It can be observed, that ASPs may as well act as application owners or vice versa to extend their business portfolio. However, separating business and technical services can typically be found in industry.

An ASP has to use services of further service providers for certain services such as Internet connectivity or storage space. An Internet service provider (ISP) provides the connectivity at a certain quality, limited by the structure of the Internet itself. A storage service provider (SSP) provides data storage capacities. These parties are not discussed here because there are a lot of well-known industrial examples for these types.

2.3 Relationships in the auction scenario

Figure 1 shows the relationships between the parties in terms of SLAs and special relationships. In this section we present the results of the discussions of the participants relationships. According to the TAPAS results, SLAs will be specified in a dedicated language called SLAng. A key characteristic of a SLA specified in SLAng is the separation of client and server obligations.

The electronic service SLA is utilised for two different types of relationships. Firstly it is used to specify the QoS-regulations between the auctioneer and the auction application owner. Such an SLA typically contains business-related objectives such as:

- The server ensures that even during peak periods the invocation of operation “place bid” is successfully completed within two seconds.
- The client may not access the application with more than ten parallel users.

The level of abstraction in such an SLA reflects the type of relationship between auctioneer and application owner: none of them may have deep technical knowledge. The type of second electronic service SLA describes the relationship between the application owner and the external business service. This does not differ very much from the first type, though the relationship is clearly limited to a dedicated service.

Terms and conditions govern the relationship between the application owner and the users, i.e. the suppliers. In industrial scenarios users may alternatively be bound to terms and conditions issued by the auctioneer. Terms and conditions are used to define standard relationships here, which do not contain individual agreements. Due to the high number of users it would be rather difficult to negotiate individual SLAs with each user. Furthermore their weak position forces them to accept the conditions. On the other hand suppliers are interested in a guarantee of obtaining their rights. Hence the TTP will supervise terms and conditions as well.

Hosting SLAs are used to specify the QoS between the ASP and the application owner. They contain the objectives of the electronic service SLA because the application owner will be eager to delegate the objectives to other providers. Due to the more technically oriented relationship between application owner and ASP, the hosting SLA contains as well technical objectives such as memory space and utilisation regulations for technical services such as user management, maintenance windows etc.

Communication SLAs specify QoS objectives for the relationship between ASP and ISP. In today’s industrial practice communication SLAs are quite well-known, though usually not specified in SLAng. Various tools exist to monitor certain aspects. In the current discussion, we therefore omit this type at present.

Persistence SLAs are used to specify QoS objectives for data storage service offered by an SSP. The success of the SSP business model is currently limited by extremely cheap hardware for main memory and disk space. Hence we do not focus on this relationship at present.

3 Technical solutions

In section 2 we discussed the different participants in the B2B auction scenario. We can observe two main types of relationships. Firstly, some of the participants collaborate despite a more or less anonymous character of their relationship, e.g. the suppliers participate in perhaps only one auction. Secondly, other participants typically cooperate in long-term relationships such as the ASP and the ISP or SSP, because the ASP usually bundles several services into the ones provided. This separation leads to different solutions, that address the incorporated problems.

The ASP-related QoS-control is addressed in TAPAS by the TAPAS middleware extensions. In order to build a fundament for a broad dissemination the TAPAS team decided to extend a J2EE application server called JBoss, which is available as an open source project. The most important concepts of the extension are discussed in section 3.1.

The QoS- and trust-related solutions require a balance between measurement overhead and economic relevance. The concepts discussed in the second TAPAS year are reflected in section 3.2, followed by a short discussion of the influence of networking solutions.

3.1 J2EE application server extensions

The TAPAS middleware extensions are designed to supervise and control the quality of middleware services and hence in turn of application services. The therefore required QoS-specifications, listed in a hosting SLA, can be modelled and analysed with methods and tools provided by the TAPAS team at University College of London (UCL). Hosting SLAs are expressed in SLAng, a language developed for SLAs.

A SLAng specification is formalised and can be read and interpreted by programs. Hence the TAPAS extensions to the application server make use of this possibility and configure and supervise the application server according to the specified objectives. The interpreter for SLAng has been developed by UCL as well and offers an API for utilisation in other components.

Middleware services can be designed in two principle ways:

- The application using the service explicitly has to call an API method.
- The application implicitly uses middleware services by implementing abstract specifications, which are then transparently executed by the middleware framework. Thus, the application is unaware of the service execution, it only needs to comply to a standard way of implementation.

J2EE applications typically use both ways. A naming service for instance is used by explicit calls to the JNDI service, while programmers gain container-managed persistence for entity beans by providing a small set mostly declarative files such as deployment descriptors for an entity bean.

However, during the design of the middleware services the TAPAS team had to decide in which way QoS-related services have to be implemented. Based on the observation that existing applications would need to be migrated to a TAPAS middleware framework in order to gain QoS-supervision and configuration capabilities, we decided to keep the application unaware of the TAPAS extensions.

Thus, existing J2EE applications can be migrated to the TAPAS middleware framework, in many cases even without changing the application's source code.

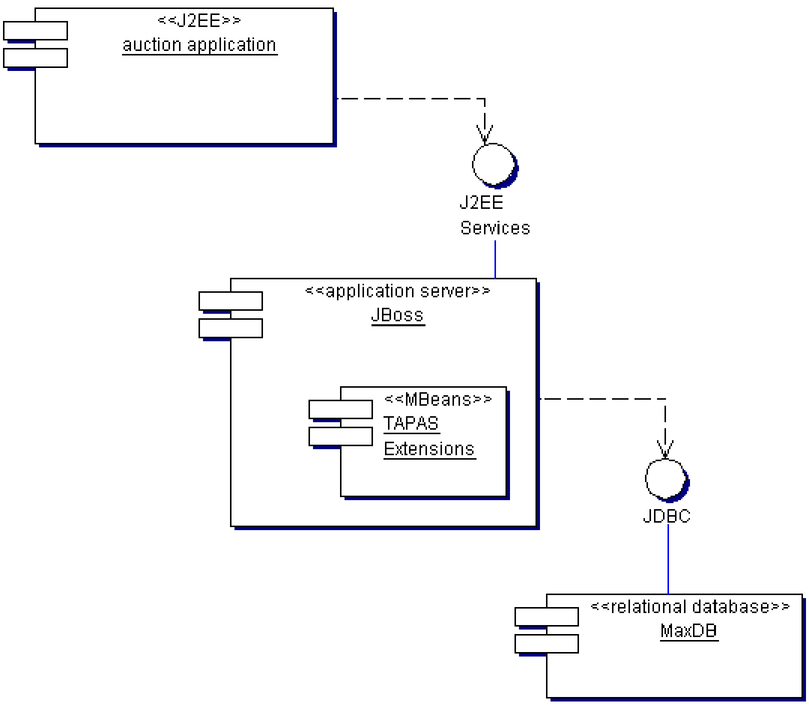

Figure 2

The JBoss extensions developed by project partners at Universitá di Bologna (UNIBO) and University of Newcastle (NCL) utilise the interceptor concept to seamlessly integrate with JBoss. This turns out to be a very promising approach as other application server vendors such as BEA and IBM adopt the MBean and interceptor concepts.

Figure 2 shows the relationships between the application, the application server and the TAPAS extensions, which are contained as a component inside the application server. The application only uses standard J2EE interfaces.

Even aside from the ASP scenario this allows to gather data about the application's behaviour inside the application server, which leads to interesting perspectives in software development and tuning.

It should be mentioned that application servers are typically run in clusters, providing load-balancing and availability. Monitoring and reconfiguration services as currently developed by UNIBO and NCL integrate and even extend these mechanisms. With respect to distributed enterprises the TAPAS team discussed various clustering scenarios, including clustering via virtual private networks (VPN). Currently UNIBO and NCL are evaluating with help of CAM, if VPN-based clusters may overcome completely distributed scenarios, in which application servers cooperate without traditional clustering.

3.2 Inter-organisational regulations and QoS monitoring

TAPAS aims to increase trust in business relationships by providing means to supervise inter-organisational contracts and the fulfilment of QoS agreements. These means will then be used by a trusted third party to check fairness and fulfilment.

Due to the fact that the participants reside at distributed locations it is quite costly to install dedicated measuring devices at various locations. In Internet-based scenarios users will typically use browsers to access an application. Hence it is quite difficult to convince users to install additional measuring components, even if they can benefit from the supervision.

One possibility for a TTP to gather data such as availability and response time of a service is to probe the service regularly. These additional requests can have a direct influence on the applications performance, causing QoS-problems themselves.

However, the TAPAS team had to inspect the possible approaches carefully and decided to have a measurement component at the ASP. On the one hand the component can make use of the already existing TAPAS middleware extensions in order to reuse existing sensors. On the other hand it can be accessed by the components used by the TTP in order to retrieve measurement data and other information. It is obvious that such an interface can utilise Web Services technology to provide data to the TTP, though security is of course a serious concern.

Inter-organisational regulations are outlined in specifications called xcontracts, while the interpretation of the regulation is based on finite state machines (FSM). Monitoring of SLA fulfilment relies on the already mentioned SLAng interpreter and on local sensors, which partly may belong to the TAPAS middleware.

3.3 Network and group communication

It is worth noting that the application server extensions as well as the inter-organisational regulation and QoS monitoring do not only make use of network layer protocols, sensors and techniques, but adopt strategies and solution patterns coined in the network community. The TAPAS team therefore exploits the knowledge of the partners at University of Cambridge (CAM).

Group communication mechanisms for instance are not only planned to be used to implement administration protocols for cluster nodes, but as well for interactions among the components of TTP and ASP.

4 Outlook

The second year of the TAPAS project focused on design and implementation of a coherent technical platform, which consists of dedicated solutions for the different problem areas. This avoids redundancy and allows to build adequate solutions at the end by selecting the required TAPAS components.

However, in the third year the TAPAS team has to focus on finalising the current implementations and gaining evaluation results in realistic contexts. The installations used for evaluation and testing will as well subsequently be used for demonstration purposes, which build an important part of the dissemination plans. Demonstrations will not only be given in scientific context but as well for adesso clients from different industrial sectors.

Part of the evaluation process is the inspection of how the usage of TAPAS tools and techniques will change the ASP processes. It seems to be necessary that an ASP will run extended tests of an application on the TAPAS platform before signing a contract in order to gather significant data. On the other hand this process step could be avoided by using the Model Driven Performance Analysis methods and tools from UCL.

Conclusively speaking the third year will be coined by evaluation and dissemination activities. Among the dissemination activities is the integration of the TAPAS middleware extensions into the JBoss open source community.

5 Feedback at the Industrial Advisory Board Meeting

The members of the IAB were invited to meet with the TAPAS Executive Board at the TAPAS EB/IAB Meeting, held in London on 2nd February, 2004. Three members of the IAB attended: Prof. Dr. Rudolf Keller (Zühlke Engineering), Dr. Stuart Wheater (Arjuna Technologies), Paul McKee (BT exact Technologies).

This section summarises the remarks made by these IAB members with regard to the progress of TAPAS by February 2003, as evidenced by the presentations. The following presentations were made:

1. Overview, Santosh Shrivastava, Ncl
2. Service Level Agreement Language, James Skene, UCL
3. QoS Management, Monitoring and Adaptation, Fabio Panzieri, Bologna
4. QoS Monitoring and Violation Detection, Carlos Molina, Ncl
5. Evaluation approach for TAPAS, Werner Beckmann, Adesso
6. ‘Under the bonnet’, Jon Crowcroft, Cambridge

Much of the discussion centred on the talks made by Bologna (QoS Management, Monitoring and Adaptation) and Newcastle (QoS Monitoring and Violation Detection).

QoS Management, Monitoring and Adaptation:

Bologna is about to set up an experiment on clustering across all sites - we are keen to know from IAB members if they thought this was a good idea. In general there was acknowledgment that it would be and that the results would be interesting. Paul McKee thought that this is a good idea in terms of providing QoS over wide area clusters. Paul McKee enquired why we are using JBoss, when earlier analysis made positive comments on JOnAS. Fabio Panzieri stated that using interceptors in JBoss enables easy accommodation of monitoring and trust related enhancements; further JBoss currently has better load-balancing and clustering facilities.

QoS Monitoring and Violation Detection:

This talk raised an interesting point concerning violation detection between parties involved (ISP and service consumer) that will require the project team to think through the ‘monitoring’ in more detail. Shrivastava asked what industry (BT) does now. Paul McKee replied if the customer pays enough then all eventualities are covered including monitoring of the ‘service consumer’. On the whole different strategies are needed for different problems.

Rudolf Keller said that having missed the last meeting (April ’03), he is impressed at how much progress has been made. He can see that the implementation stage will be most interesting and is curious to learn the results in due course. Paul McKee agreed that the project was at an interesting stage and looked forward to the results of the geographical clustering experiment from Bologna. This would be a nice QoS feature if successful.

6 Demonstration Scenarios

In this chapter we will outline the main areas of interest we will feature in our presentation of the demonstrator in September. In the following we will briefly depict the covered topics and indicate what we will present at the meeting.
For all features and scenarios we will try to have look from an industry point of view and will emphasize on the commercial benefits and the expected impact on the ASP business as a whole.

6.1 SLA Modelling

The first part of the demonstration will present the formal representation of a SLA definition.

The TAPAS project uses a formal SLA notation called SLAng to express non functional aspects in XML. This approach eases the automated processing and generation. It is missioned to have GUI-Tools able to generate the files and therefore it will be possible for an inexperienced user to generate an appropriate SLAng file.

The XML definition also eases the data import for the model checking tools which will be available in the future. The SLA file will also be the basis to generate further specialized definition files e.g. for the dynamic cluster configuration (see 6.3). The XML file approach is also very suitable in the context of component based software development. The current J2EE model uses XML files to configure the container services. Therefore the TAPAS XML definitions are a seamless way to configure the new QoS container services in the application server.

The demonstration will feature an example XML file that will include typical SLA elements for the chosen auctioning application. Examples could be:

- The portal site will be accessible for 98% of the time.
- Access to the e-controlling component is ensured for 90% of the time.
- The minimal recovery time for the access to individual customer data is 20 minutes, the recovery time for profile data is 60 minutes.

The more advanced topics like tool-based XML generation, model verification or the definition files for the clustered environment will not be shown at this stage of the project.

6.2 Non-Repudiation

Non-repudiation is a key element to build trust between different organizations. Combined with authentication it is a key element to allow trusted coordination across organisational borders. The developed protocols will ease the exchange of resources and services between companies. Trusted third parties could also enable business partnerships between mistrusting parties (see 6.4). The non-repudiation of the called methods and services leads to conclusive log-files. Therefore the ASP or service provider can present evident logs to confirm his billing procedures. In the given demonstrator application of the auctioning service the logs would also show if a

person really placed a bid and if the processing was accomplished without SLA violations.
The demonstration will present the first protocols that ensure two-party non-repudiation. We will show protocols that work on the RMI-invocation layer. This will allow to secure the communication between the web server module and the ejb-container of the application server. But the used concepts and protocols can be extended to be used for communication with external services and geographically distributed clusters in an inter-organizational environment as well.
The demonstration will feature automatically modified stubs and skeletons which utilize the mentioned protocols to achieve non-repudiation. The source code of the application does not need to be modified.

6.3 Dynamic Clustering

Current application servers offer clustering and high availability on a best effort basis. The cluster tries to be protected from service outage by providing multiple instances of each resource that represents a single point of failure. Multicast Protocols, session replication etc. ensure that the whole cluster remains intact if one or more server crashes. However this type of cluster is static in the way that is consists of a given number of resources and is protected against the loss of some services. It offers no way to dynamically adjust the level of availability to customer needs.
The TAPAS-enhanced application servers offer dynamic management of availability. The TAPAS extensions read the required availability constraints from a configuration file that is a modified representation of the SLAng XML file. This information is interpreted to dynamically control the cluster of application server instances. For example it would be possible to define different levels of availability depending on the time of day or day of week. Based on the needed level of availability the TAPAS extensions would use more or less servers in the cluster. If a server crashed the system could also dynamically request another server to join the cluster to ensure the service level until the crashed server rejoins the cluster.
Load-balancing is another area of static resource use in current clustered environments. All available load-balancing algorithms in today's productive application server systems try to distribute the user-requests in order to keep the response time low. But all systems only offer a best effort approach. They offer no way to monitor and influence the load-balancing. Therefore these servers cannot offer QoS services. TAPAS introduces dynamic load-balancing between replicated containers.
Current algorithms such as round-robin cannot exploit the full potential of mixed server environments. The monitoring facilities of the TAPAS extensions offer more insight on the current workload of the whole system and even special parts or services. This monitoring is used to check for violations of the SLAs and can take actions to meet the QoS needs of the application. Possible actions to avoid QoS violations could be adjustments of the load-balancing but also the dynamic start of additional server instances to split the workload on more servers.
This dynamic way to use the hardware resources could significantly lower the costs for a high availability cluster and add the benefit of QoS capabilities. If a mid-range company needs much processing power or high availability at special time periods the resulting hardware setup will be oversized for most of the time. The dynamic resource allocation at an ASP will allow the company to buy only the needed capacity. Therefore the company could react on changing needs more quickly and reduce the investment in hardware. This new features will also allow the ASP providers to use their existing hardware more efficiently.

The presentation will feature a comparison between a off-the-shelf JBoss and a TAPAS enhanced version. We will show dynamic load-balancing on a local level. The setup for a geographically distributed cluster would be to complex for the demonstration, but the functionality is available.
In the test case we will kill a node to see how the two types of clusters react on the loss. To simulate a typical workload we will use OpenSTA or another appropriate tool to generate the load. We will also measure the overhead caused by the TAPAS extensions compared to the normal JBoss hosting the application. It would also be possible modify the ECPerf benchmark to use the TAPAS enhancements.

6.4 Trusted Third Parties (TTPs)

As mentioned in 6.2 the concept of trusted third parties is vital to enable business relationships and service offerings between distrusting parties. This set-up could convince hesitating companies to use ASP or external services. If security or fair billing is a concern the supervision of an independent third party could convince customers.
This facility would also enable companies to control the services if they do not have the resources or knowledge to control the service company. Another example could be a company that wants to make sure that the data is encrypted at all times and not accessible to external services a TTP could supervise encryption and monitor the data access with the authentication and non- repudiation mechanisms mentioned earlier.
The main function of the TTP is a mediator function between the distrusting parties. The trust in the TTP is achieved by the independence of both parties and the impartial control of the SLA fulfilment. After successful cooperation between the parties new trust relationships between the parties might build up. This could lead to less restrictive security constraints and an extended exchange of services.
Technically the TTPs are using a QoS-monitoring components to supervise the actions of the involved parties. The QoS-monitor automatically gathers data about the current service levels and detects SLA violations. The violations are automatically detected with a comparison of the service level definitions from the SLAng specification and the observed service performance.
In the demonstration we will use a load-tool to generate to many requests for the given hardware and SLA setup. These SLA violations lead to alarms in the QoS-monitoring component. This will trigger a component called “finite state machine”. This component can send notifications or cause a penalty. All violations will be logged. The violations are reported in intervals and not real-time to keep network usage down nonetheless this system keeps track of all service violations.
The finite state machine (FSM) offers a sophisticated approach to act on contract violations. This model allows complex definitions and actions based on the history of events. Therefore the penalty or taken action depends on the violation itself but also on the context and timeframe it happens in.

6.5 QoS-aware Integration of External Services

The TAPAS platform will not only allow the integration of distributed TAPAS components from other companies or locations but also the integration of services that do not implement TAPAS QoS-services. These external services can be integrated with web services or the Java Connector Architecture (JCA). These legacy systems do not offer QoS abilities and therefore will not change their behaviour based on e.g. the service load but we will use the TAPAS framework to integrate the monitoring capabilities. This will enable automatic control of the SLAs and log the service quality and the violations of the agreement. This offers new ways to detect

and act on SLA violations. At present it is not possible to reliably monitor the quality of an external service. Just pinging the service will not lead to viable results but it is also not possible to constantly send dummy-requests with real data to probe the service. Measuring the real performance is the only dependable option.
This leads to a new level of quality assurance. The TAPAS logs will offer a detailed view of the service quality this data can be used to benchmark different services and act on service violations (e.g. evasion to a different service or penalty payments).
In our demonstration we will show the monitoring of an external service and the detection of a service violation.

Besides all the single areas of interest highlighted in the previous paragraphs we also want to assess the performance indications of the TAPAS framework. The first interesting area is the performance impact caused by the TAPAS framework itself. We will compare the off-the-shelf JBoss and the TAPAS-JBoss with the demonstrator application with the same workload. This will give us a clearer picture of the performance loss caused by TAPAS. In particular, it will be useful to validate the assumptions that have been made during the initial design about the performance of operation executions and the load characteristics against data gathered during the performance.
The second area are the new refined ways to measure application performance. Already to date, application services are designed in an incremental and iterative manner. But measuring the performance of real-world applications is not easy. Normally the application is examined with performance analysers like JProbe. These analysers plug into the Java Virtual Machine and help to find bottlenecks. However this approach is slow and influences the test results by the measuring self. You cannot use the real servers and therefore the results are not fully comparable to the real application behaviour. The TAPAS framework will offer new insights to the application and its performance in everyday use. The SLA monitoring data gathered will provide very valuable data for the tuning of the design. This feature could significantly improve the tuning and enhancement of existing applications.

7 Publications

This section lists the publications during the 2nd year of the project.

7.1 Conferences and Workshops

TAPAS project members attended the following conferences during the first year of the project:

14th Database and Expert Systems Applications (DEXA'03) attended by Nicola Mezzetti.

Test and Analysis of Component Based Systems, 13th April, overall European Joint Conferences on Theory and Practice of Software (ETAPS) in Warsaw 5 – 13 April '03 attended by J Skene.

Future Trends of Distributed Computing Systems (FTDCS) May 28 30, 2003, Puerto Rico attended by D. Lamanna

IEEE International Conference on Electronic Commerce, Newport Beach, CA, June 2003, attended by Carlos Molina

4th IEEE International Workshop on Policies for Distributed Systems and Networks, Lake of Como, 4-6 June 2003 attended by A di Ferdinando

Middleware 2003 16-20 June 2003, Brazil attended by D Lamanna

7th International Conference on Internet, Multimedia Systems and Applications (IMSA 2003), Honolulu, (HI), August 2003.

Workshop on Revisiting IP QoS: Why do we care, what have we learned? (RIPQOS) Karlsruhe, Germany, August 27, 2003 attended by Jon Crowcroft and Panos Gevros

Seventeenth Annual IFIP WG 11.3 Working Conference on Data and Applications Security, Estes Park, Colorado, August 2003, attended by Santosh Shrivastava

IEEE International Conference on Information Technology: Research and Education (ITRE 2003), Newark (NJ), August 2003

Bertinoro Summer School on Formal Methods for Software, Bertinoro, Italy, 22-24 September, 2003 attended by W. Emmerich

Bertinoro International Spring School for Graduate Studies in Computer Science, 8-19 March 2004, attended by Santosh Shrivastava (presented a course on middleware)

14th DEXA Workshops 2003, Prague, Czech Republic, 1-5 Sept. 2003.

Workshop on Service Based Software Engineering in Pisa (FM2003-SBSE), 8th September with FME, Pisa, 8 – 14 Sept. 03 attended by J Skene

8th CaberNet Radicals Workshop, Ajaccio, Corsica, 5-8 October 2003.

5th CaberNet Plenary Workshop, 5-7 November 2003, Porto Santo, Portugal

3rd International Conference on Networking (ICN'04), February 29 - March 4, 2004: Creole Beach Hotel, Gosier, Guadeloupe, French Caribbean.

7.2 Publications

Amoroso, A. and Panzieri, F., "*A scalable architecture for responsive auction services over the Internet*", TR UBLCS-2003-09, Dept. of Computer Science, University of Bologna, June 2003.

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