



Elysium Technologies Private Limited

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IEEE FINAL YEAR PROJECTS 2012 – 2013

Webservices

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WEBSERVICES

2012 - 2013

EGC
9201

A Flexible Approach to Improving System Reliability with Virtual Lockstep

Scientific workflow has recently become an enabling technology to automate and speed up the scientific discovery process. Although several scientific workflow management systems (SWFMSs) have been developed, a formal scientific workflow composition model in which workflow constructs are fully compositional one with another is still missing. In this paper, we propose a dataflow-based scientific workflow composition framework consisting of (1) a dataflow-based scientific workflow model that separates the declaration of the workflow interface from the definition of its functional body; (2) a set of workflow constructs, including Map, Reduce, Tree, Loop, Conditional, and Curry, which are fully compositional one with another; (3) a dataflow-based exception handling approach to support hierarchical exception propagation and user-defined exception handling. Our workflow composition framework is unique in that workflows are the only operands for composition; in this way, our approach elegantly solves the two-world problem in existing composition frameworks, in which composition needs to deal with both the world of tasks and the world of workflows. The proposed framework is implemented and several case studies are conducted to validate our techniques.

EGC
9202

A Model for Checking Contractual Compliance of Business Interactions

The electronic representation of a contract for a business-to-business (B2B) partnership should be such that it can be used by a monitoring service for compliance checking of B2B interactions at runtime, ensuring that the interactions match the rights and obligations that each partner has promised to honor. With this view in mind, the paper develops a model for checking contractual compliance of business interactions. Specifically, the paper develops a novel way of representing contract clauses using business rules, that is specially suited to compliance checking and describes what events need to be captured from the underlying messaging middleware and how they can be processed in a careful manner to evaluate contractual compliance.

EGC
9203

A Proxy-Based Architecture for Dynamic Discovery and Invocation of Web Services from Mobile Devices

Mobile devices are getting more pervasive, and it is becoming increasingly necessary to integrate web services into applications that run on these devices. We introduce a novel approach for dynamically invoking web service methods from mobile devices with minimal user intervention that only involves entering a search phrase and values for the



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method parameters. The architecture overcomes technical challenges that involve consuming discovered services dynamically by introducing a man-in-the-middle (MIM) server that provides a web service whose responsibility is to discover needed services and build the client-side proxies at runtime. The architecture moves to the MIM server energy-consuming tasks that would otherwise run on the mobile device. Such tasks involve communication with servers over the Internet, XML-parsing of files, and on-the-fly compilation of source code. We perform extensive evaluations of the system performance to measure scalability as it relates to the capacity of the MIM server in handling mobile client requests, and device battery power savings resulting from delegating the service discovery tasks to the server.

EGC
9204

Adaptive SOA Solution Stack

Mobile devices are getting more pervasive, and it is becoming increasingly necessary to integrate web services into applications that run on these devices. We introduce a novel approach for dynamically invoking web service methods from mobile devices with minimal user intervention that only involves entering a search phrase and values for the method parameters. The architecture overcomes technical challenges that involve consuming discovered services dynamically by introducing a man-in-the-middle (MIM) server that provides a web service whose responsibility is to discover needed services and build the client-side proxies at runtime. The architecture moves to the MIM server energy-consuming tasks that would otherwise run on the mobile device. Such tasks involve communication with servers over the Internet, XML-parsing of files, and on-the-fly compilation of source code. We perform extensive evaluations of the system performance to measure scalability as it relates to the capacity of the MIM server in handling mobile client requests, and device battery power savings resulting from delegating the service discovery tasks to the server.

EGC
9205

Bootstrapping Ontologies for Web Services

Ontologies have become the de-facto modeling tool of choice, employed in many applications and prominently in the semantic web. Nevertheless, ontology construction remains a daunting task. Ontological bootstrapping, which aims at automatically generating concepts and their relations in a given domain, is a promising technique for ontology construction. Bootstrapping an ontology based on a set of predefined textual sources, such as web services, must address the problem of multiple, largely unrelated concepts. In this paper, we propose an ontology bootstrapping process for web services. We exploit the advantage that web services usually consist of both WSDL and free text descriptors. The WSDL descriptor is evaluated using two methods, namely Term Frequency/Inverse Document Frequency (TF/IDF) and web context generation. Our proposed ontology bootstrapping process integrates the results of both methods and applies a third method to validate the concepts using the service free text descriptor, thereby offering a more accurate definition of ontologies. We extensively validated our bootstrapping method using a large repository of real-world web services and verified the results against existing ontologies. The experimental results indicate high precision. Furthermore, the recall versus precision comparison of the results when each method is separately



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implemented presents the advantage of our integrated bootstrapping approach. d (MPPS) mean throughput. Being hash-oriented, CoLT well supports incremental table updates, besides its high table utilization and lookup throughput.

EGC
9206

Business-OWL (BOWL)—A Hierarchical Task Network Ontology for Dynamic Business Process Decomposition and Formulation

web as a medium of business collaboration, there is an increasing need to quickly and dynamically form cBPs. However, current Business-to-Business (B2B) information systems are still static in nature, and are unable to dynamically form cBPs based on high-level Business Goals (BGs) and their underlying criteria (e.g., item cost, product name, order quantity, etc). This paper introduces the Business-OWL (BOWL), an ontology rooted in the Web Ontology Language (OWL), and modeled as a Hierarchical Task Network (HTN) for the dynamic formation of business processes. An ontologized extension and augmentation of traditional HTN, BOWL describes business processes as a hierarchical ontology of decomposable business tasks encompassing all possible decomposition permutations. Through BOWL, high-level business goals (e.g., "Buy") can be easily decomposed right down to the lowest level tasks (e.g., "Send Purchase Order"), effectively bridging the gap between high-level business goals with operational level tasks and complementing currently static business process modeling languages. The design of BOWL and a case study demonstrating its implementation are also discussed.

EGC
9207

Collaborative Testing of Web Services

This With the increase of energy consumption associated with IT infrastructures, energy management is becoming a priority in the design and operation of complex service-based systems. At the same time, service providers need to comply with Service Level Agreement (SLA) contracts which determine the revenues and penalties on the basis of the achieved performance level. This paper focuses on the resource allocation problem in multitier virtualized systems with the goal of maximizing the SLAs revenue while minimizing energy costs. The main novelty of our approach is to address-in a unifying framework-service centers resource management by exploiting as actuation mechanisms allocation of virtual machines (VMs) to servers, load balancing, capacity allocation, server power state tuning, and dynamic voltage/frequency scaling. Resource management is modeled as an NP-hard mixed integer nonlinear programming problem, and solved by a local search procedure. To validate its effectiveness, the proposed model is compared to top-performing state-of-the-art techniques. The evaluation is based on simulation and on real experiments performed in a prototype environment. Synthetic as well as realistic workloads and a number of different scenarios of interest are considered. Results show that we are able to yield significant revenue gains for the provider when compared to alternative methods (up to 45 percent). Moreover, solutions are robust to service time and workload variations.

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9208

Dynamic Authentication for Cross-Realm SOA-Based Business Processes



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Modern distributed applications are embedding an increasing degree of dynamism, from dynamic supply-chain management, enterprise federations, and virtual collaborations to dynamic resource acquisitions and service interactions across organizations. Such dynamism leads to new challenges in security and dependability. Collaborating services in a system with a Service-Oriented Architecture (SOA) may belong to different security realms but often need to be engaged dynamically at runtime. If their security realms do not have a direct cross-realm authentication relationship, it is technically difficult to enable any secure collaboration between the services. A potential solution to this would be to locate intermediate realms at runtime, which serve as an authentication path between the two separate realms. However, the process of generating an authentication path for two distributed services can be highly complicated. It could involve a large number of extra operations for credential conversion and require a long chain of invocations to intermediate services. In this paper, we address this problem by designing and implementing a new cross-realm authentication protocol for dynamic service interactions, based on the notion of service-oriented multiparty business sessions. Our protocol requires neither credential conversion nor establishment of any authentication path between the participating services in a business session. The correctness of the protocol is formally analyzed and proven, and an empirical study is performed using two production-quality Grid systems, Globus 4 and CROWN. The experimental results indicate that the proposed protocol and its implementation have a sound level of scalability and impose only a limited degree of performance overhead, which is for example comparable with those security-related overheads in Globus 4.

EGC
9209

Energy-Aware Autonomic Resource Allocation in Multitier Virtualized Environments

With the increase of energy consumption associated with IT infrastructures, energy management is becoming a priority in the design and operation of complex service-based systems. At the same time, service providers need to comply with Service Level Agreement (SLA) contracts which determine the revenues and penalties on the basis of the achieved performance level. This paper focuses on the resource allocation problem in multitier virtualized systems with the goal of maximizing the SLAs revenue while minimizing energy costs. The main novelty of our approach is to address-in a unifying framework-service centers resource management by exploiting as actuation mechanisms allocation of virtual machines (VMs) to servers, load balancing, capacity allocation, server power state tuning, and dynamic voltage/frequency scaling. Resource management is modeled as an NP-hard mixed integer nonlinear programming problem, and solved by a local search procedure. To validate its effectiveness, the proposed model is compared to top-performing state-of-the-art techniques. The evaluation is based on simulation and on real experiments performed in a prototype environment. Synthetic as well as realistic workloads and a number of different scenarios of interest are considered. Results show that we are able to yield significant revenue gains for the provider when compared to alternative methods (up to 45 percent). Moreover, solutions are robust to service time and workload variations.

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9210

Expert Discovery and Interactions in Mixed Service-Oriented Systems



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Web-based collaborations and processes have become essential in today's business environments. Such processes typically span interactions between people and services across globally distributed companies. Web services and SOA are the defacto technology to implement compositions of humans and services. The increasing complexity of compositions and the distribution of people and services require adaptive and context-aware interaction models. To support complex interaction scenarios, we introduce a mixed service-oriented system composed of both human-provided and Software-Based Services (SBSs) interacting to perform joint activities or to solve emerging problems. However, competencies of people evolve over time, thereby requiring approaches for the automated management of actor skills, reputation, and trust. Discovering the right actor in mixed service-oriented systems is challenging due to scale and temporary nature of collaborations. We present a novel approach addressing the need for flexible involvement of experts and knowledge workers in distributed collaborations. We argue that the automated inference of trust between members is a key factor for successful collaborations. Instead of following a security perspective on trust, we focus on dynamic trust in collaborative networks. We discuss Human-Provided Services (HPSs) and an approach for managing user preferences and network structures. HPS allows experts to offer their skills and capabilities as services that can be requested on demand. Our main contributions center around a context-sensitive trust-based algorithm called ExpertHITS inspired by the concept of hubs and authorities in web-based environments. ExpertHITS takes trust-relations and link properties in social networks into account to estimate the reputation of users.

EGC
9211

Optimization of Resource Provisioning Cost in Cloud Computing

In cloud computing, cloud providers can offer cloud consumers two provisioning plans for computing resources, namely reservation and on-demand plans. In general, cost of utilizing computing resources provisioned by reservation plan is cheaper than that provisioned by on-demand plan, since cloud consumer has to pay to provider in advance. With the reservation plan, the consumer can reduce the total resource provisioning cost. However, the best advance reservation of resources is difficult to be achieved due to uncertainty of consumer's future demand and providers' resource prices. To address this problem, an optimal cloud resource provisioning (OCRP) algorithm is proposed by formulating a stochastic programming model. The OCRP algorithm can provision computing resources for being used in multiple provisioning stages as well as a long-term plan, e.g., four stages in a quarter plan and twelve stages in a yearly plan. The demand and price uncertainty is considered in OCRP. In this paper, different approaches to obtain the solution of the OCRP algorithm are considered including deterministic equivalent formulation, sample-average approximation, and Benders decomposition. Numerical studies are extensively performed in which the results clearly show that with the OCRP algorithm, cloud consumer can successfully minimize total cost of resource provisioning in cloud computing environments

EGC
9212

Query Access Assurance in Outsourced Databases

Query execution assurance is an important concept in defeating lazy servers in the database as a service model. We show that extending query execution assurance to outsourced databases with multiple data owners is highly inefficient.



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To cope with lazy servers in the distributed setting, we propose query access assurance (Qaa) that focuses on IO-bound queries. The goal in Qaa is to enable clients to verify that the server has honestly accessed all records that are necessary to compute the correct query answer, thus eliminating the incentives for the server to be lazy if the query cost is dominated by the IO cost in accessing these records. We formalize this concept for distributed databases, and present two efficient schemes that achieve Qaa with high success probabilities. The first scheme is simple to implement and deploy, but may incur excessive server to client communication cost and verification cost at the client side, when the query selectivity or the database size increases. The second scheme is more involved, but successfully addresses the limitation of the first scheme. Our design employs a few number theory techniques. Extensive experiments demonstrate the efficiency, effectiveness, and usefulness of our schemes.

EGC
9213

RLM: A General Model for Trust Representation and Aggregation

Reputation-based trust systems provide important capability in open and service-oriented computing environments. Most existing trust models fail to assess the variance of a reputation prediction. Moreover, the summation method, widely used for reputation feedback aggregation, is vulnerable to malicious feedbacks. This paper presents a general trust model, called RLM, for a more comprehensive and robust reputation evaluation. Concretely, we define a comprehensive reputation evaluation method based on two attributes: reputation value and reputation prediction variance. The reputation predication variance serves as a quality measure of the reputation value computed based on aggregation of feedbacks. For feedback aggregation, we propose the novel Kalman aggregation method, which can inherently support robust trust evaluation. To defend against malicious and coordinated feedbacks, we design the Expectation Maximization algorithm to autonomously mitigate the influence of a malicious feedback, and further apply the hypothesis test method to resist malicious feedbacks precisely. Through theoretical analysis, we demonstrate the robustness of the RLM design against adulating and defaming attacks, two popular types of feedback attacks. Our experiments show that the RLM model can effectively capture the reputation's evolution and outperform the popular summation-based trust models in terms of both accuracy and attack resilience. Concretely, under the attack of collusive malicious feedbacks, RLM offers higher robustness for the reputation prediction and a lower false positive rate for the malicious feedback detection.

EGC
9214

Runtime Enforcement of Web Service Message Contracts with Data

An increasing number of popular SOAP web services exhibit a stateful behavior, where a successful interaction is determined as much by the correct format of messages as by the sequence in which they are exchanged with a client. The set of such constraints forms a “message contract” that needs to be enforced on both sides of the transaction; it often includes constraints referring to actual data elements inside messages. We present an algorithm for the runtime monitoring of such message contracts with data parameterization. Their properties are expressed in LTL-FO+, an extension of Linear Temporal Logic that allows first-order quantification over the data inside a trace of XML messages. An implementation of this algorithm can transparently enforce an LTL-FO+ specification using a small and invisible Java applet. Violations of the specification are reported on-the-fly and prevent erroneous or out-of-sequence XML messages



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from being exchanged. Experiments on commercial web services from Amazon.com and Google indicate that LTL-FO+ is an appropriate language for expressing their message contracts, and that its processing overhead on sample traces is acceptable both for client-side and server-side enforcement architectures.

EGC
9215

Semantics-Based Automated Service Discovery

A vast majority of web services exist without explicit associated semantic descriptions. As a result many services that are relevant to a specific user service request may not be considered during service discovery. In this paper, we address the issue of web service discovery given nonexplicit service description semantics that match a specific service request. Our approach to semantic-based web service discovery involves semantic-based service categorization and semantic enhancement of the service request. We propose a solution for achieving functional level service categorization based on an ontology framework. Additionally, we utilize clustering for accurately classifying the web services based on service functionality. The semantic-based categorization is performed offline at the universal description discovery and integration (UDDI). The semantic enhancement of the service request achieves a better matching with relevant services. The service request enhancement involves expansion of additional terms (retrieved from ontology) that are deemed relevant for the requested functionality. An efficient matching of the enhanced service request with the retrieved service descriptions is achieved utilizing Latent Semantic Indexing (LSI). Our experimental results validate the effectiveness and feasibility of the proposed approach.

EGC
9216

TiCoBTx-Net: A Model to Manage Temporal Consistency of Service-Oriented Business Collaboration

Business collaboration is about coordinating the flow of information among organizations and linking their business processes into a cohesive whole. Collaborative business processes are time critical within and across organizations and can become unreliable due to temporal inconsistency where processes cannot execute according to the agreed temporal policies. It is necessary to have a mechanism to manage temporal consistency in service-oriented business collaboration. In this paper, we propose a model named Timed Choreographical Business Transaction Net (TiCoBTx-Net) based on Hierarchical Colored Petri Net for individual business participants to specify and manage the temporal consistency in business collaboration. A series of temporal policies are formalized and checked in TiCoBTx-Net to enforce the temporal consistency at design time and runtime. A verification mechanism is also developed to clarify the status of temporal inconsistencies. Finally, the implementation details of the proposed mechanism is provided.

EGC
9217

Using Rules and Data Dependencies for the Recovery of Concurrent Processes in a Service-Oriented Environment

This paper presents a recovery algorithm for service execution failure in the context of concurrent process execution. The recovery algorithm was specifically designed to support a rule-based approach to user-defined correctness in



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execution environments that support a relaxed form of isolation for service execution. Data dependencies are analyzed from data changes that are extracted from database transaction log files and generated as a stream of deltas from Delta-Enabled Grid Services. The deltas are merged by time stamp to create a global schedule of data changes that, together with the process execution context, are used to identify processes that are read and write dependent on failed processes. Process interference rules are used to express semantic conditions that determine if a process that is dependent on a failed process should recover or continue execution. The recovery algorithm integrates a service composition model that supports nested processes, compensation, contingency, and rollback procedures with the data dependency analysis process and rule execution procedure to provide a new approach for addressing consistency among concurrent processes that access shared data. We present the recovery algorithm and also discuss our results with simulation and evaluation of the concurrent process recovery algorithm.