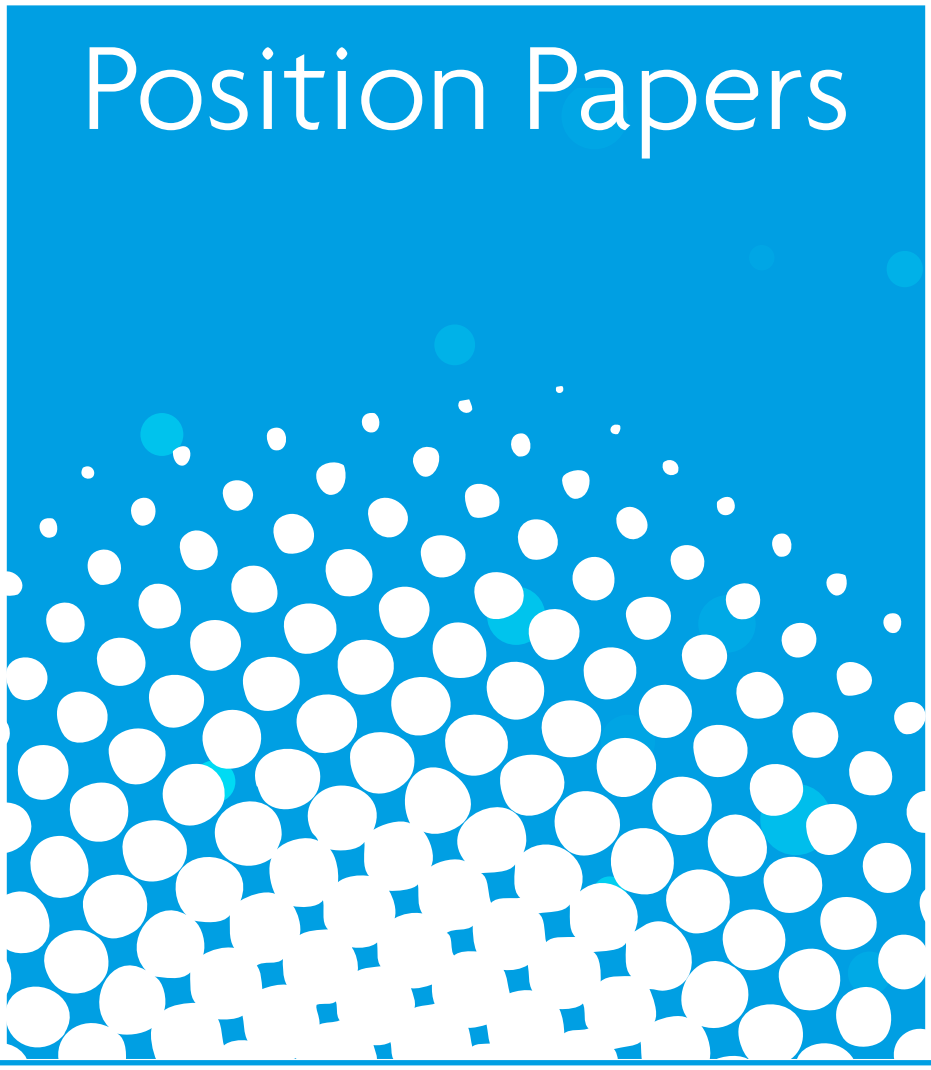
European Commission

Software & Services, Cloud Computing Concertation Meeting

Towards an interoperable European Ecosystem of services

12 - 13 March, 2014

Brussels, Belgium



Published & edited by CloudWATCH

Cloud Watch
A European Cloud observatory supporting cloud policies, standards profiles & services

www.cloudwatchhub.eu

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Introduction

It is our pleasure to welcome you to this Concertation Meeting, Towards an interoperable European Ecosystem of Services, 12-13 March 2014, hosted by the Software & Services, Cloud Computing, DG Connect.

In recent years, competitive calls have brought wide coverage of cloud computing related topics to the European research and development landscape. Funded initiatives focus on technologies specific to the networked, distributed dimension of software and access to services and data, including long-term research and emphasis on enabling software developers in Europe to easily create interoperable services based on open standards. Ensuring open source creates value in new strategic ways is another important goal. More recent initiatives give priority to heterogeneous clouds and the Internet of Things, networking, reliability, agile software prototyping, big data and better quality of service of user experience.

This timely meeting takes stock of the latest activities of all active projects of Unit E2 (including projects funded under Calls 5, 8 & 10, CIP as well as EU-Japan representation), including selected success stories to present and discuss new ideas. This dynamic and interactive event features break-out sessions, lightning talks and flash presentations serving as a spring board for discussions on cross-cutting themes and challenges not yet addressed. The sharing of best practices on standards, interoperability and portability will be complemented by external insights as part of the drive towards an interoperable and trusted ecosystem of services in Europe.

The opening talk from Ken Ducatel, Head of Software & Services, Cloud Computing, will focus on the European Cloud Strategy. On the second day, Francisco Medeiros, Deputy Head of Unit, presents H2020 LEIT ICT Funding Opportunities – ICT 7: Advanced cloud infrastructures and services and ICT 9: Tools and methods for software development, highlighting fundamental changes from FP7 to H2020 and the new prospects this brings for potential proposers.

The Concertation Meeting in numbers

We would like to thank the European Commission for hosting the workshop and all project participants for their active contributions and look forward to the first of three interactive Concertation Meetings.

Organised by the CloudWATCH project consortium

Further details on: www.cloudwatchhub.eu , info@cloudwatchhub.eu, @CloudWatchhub

CloudWATCH – Towards a European interoperable cloud ecosystem together

There is increasing evidence that consumers want "pain relief" from the lack of control, interoperability, and portability [1]. Europe therefore needs to pursue tangible ways of increasing commitment to transparency, openness and compliance across all actors in the value chain. Such an approach is particularly important as European investments in R&D focus on interoperable clouds contributing to an internal market with increased opportunities for SMEs while also fostering improved trust in cloud-based applications and storage for businesses and citizens.

Interoperability and portability are central to avoiding lock-in, whether at the technical, service delivery or business level, thus ensuring broader choice and a level playing field. Open standard interfaces protect users from vendor lock-in, helping to avoid significant migration costs whenever open interfaces are not provided. The implementation of a core set of internationally recognised standards is key to avoiding multiple, inconsistent guidelines and bespoke solutions.

CloudWATCH [2], a Support Action funded under Call 10, builds on a decade of collaborative peer work in Europe and globally, including the SIENA Roadmap [3] and the evolution towards the EGI Federated Cloud infrastructure platform [4], bringing considerable expertise in standards development, implementation and interoperability testing. CloudWATCH supports global interoperability by engaging in a multi-stakeholder dialogue to promote best practices on interoperable clouds and to build common standards profiles from use case analysis.

A standard very often supports multiple use cases in its specification text, which can lead to ambiguity and a lack of real interoperability across different interfaces. A profile on a standard clarifies in an unambiguous way how a standard has to be interpreted, explaining how to implement it based on a specific use case. Specifically, CloudWATCH is working on a portfolio of European and international use cases covering technical, policy and legal requirements, such as service level agreement management. This work will lead to the development of common standards profiles and testing around the federation of cloud services.

There is little doubt that interoperability will be critical to boosting innovation in Europe, which is where initiatives funded under the EU's programme for Software & Services, Cloud Computing come into play. The Concertation Meetings and an online survey are designed to enable these initiatives to share their specific use cases in a pragmatic and direct way.

The Concertation Meeting is also an opportunity to gain insight on standards groups working on federation, HTML5Apps and accountability with contributions from standards groups such as OGF, the Cloud Security Alliance and W3C on the one hand and interoperability use cases from the public and private sector on the other. Together, we can explore ways to turn best practices into common practices and take concrete steps based on the most relevant standards for specific use cases identified by R&D initiatives and peer support actions.

By focusing attention on issues like interoperability, security, trust, data protection and analysing certification schemes in Europe and across the globe, CloudWATCH is pushing for the commitment of all actors involved as we strive for a smart, trusted and interoperable cloud ecosystem in Europe.

References

[1] See, for example, GigaOM, The Future of Cloud Computing, 3rd Annual Survey 2013, http://ow.ly/uqOtM.

2] www.cloudwatchhub.eu.

[3] SIENA Roadmap on Distributed Computing Infrastructure for e-Science and Beyond in Europe, June 2012, http://ow.ly/uqMx8.

[4] EGI, Federated Cloud, https://www.egi.eu/infrastructure/cloud/.

Call 5, Objective 1.2 - Internet of Services, Software and Virtualisation

SOCIETIES - Self Orchestrating Community Ambient Intelligence Spaces

Micheal Crotty & Kevin Doolin, TSSG

Focus Area

The vision of SOCIETIES is to bring the pervasive and social worlds together, using the concept of community. The majority of human interaction happens in the physical world. Social Networking sites allow individuals to communicate and share their interests with other individuals in the virtual world.

While social networks allow people to be found and organised in a virtual sense, to date the integration with the physical world has only been partial. Further integration will provide exploitation potential for new service offerings.

SOCIETIES has bridged this gap by integrating pervasive technology with social computing so as to evaluate the user uptake of ambient intelligence, and thus enabling the next generation of social networking technologies.

SOCIETIES has investigated, enabled and evaluated the discovery, connection and organisation of the right people, resources, objects and services into communities of common interest.

Relevance to the EC Cloud Computing Strategy

SOCIETIES has overlapped with European Cloud Computing Strategy on a number of its undertaken actions.

Safe an Fair Contract Terms and Conditions

One of the key innovations in SOCIETIES was the development, and evaluation of the privacy protection system. This system allowed privacy preferences to be created, used as the basis for a negotiated "contract" for further data disclosure. In addition, data obfuscation policies could be applied to the data prior to disclosing it. For example, obfuscating a location to "Dublin, Ireland". A key benefit of the system was to learn these preferences in a relatively short time period.

Cutting through the jungle of standards

SOCIETIES produced an architectural deliverable, outlining the various levels of interoperability (technical, semantic, and organisational) that could be applied. A key result of this work was the identification of 11 Points of Interoperability (PoI) in SOCIETIES. This allowed potential existing / emerging standards to be identified.

Establishing a European Cloud Partnership

SOCIETIES has been actively disseminating the results of its work to a wide body of stakeholders (other EU projects, industrial fora and to the W3C). In practice, joining a existing standarisation activity is more efficient use of time.

Relevant Standards for Interoperability and Portability

The partners involved in the SOCIETIES project have been already fostering some initiatives on the standarisation process:

- SOCIETIES architecture has been presented at the Federated Social Web Summit in Berlin in June 2011

- SOCIETIES has presented its standardization roadmap during the Service Front Ends meeting which was organized in September 2011 by the European Commission

- SOCIETIES had a presentation slot at the W3C Social Business Jam, an online conversation among leaders from around the world about the current state of social business, the future role that social technologies can play in improving the bottom line, and how social technology should evolve in order to support business objectives.

- SOCIETIES has been exploring of formalizing some concrete (early) standardization process by means of the W3C community groups format. W3C Community Groups are open forums, where Web developers and other stakeholders develop specifications, hold discussions, develop test suites, and connect with W3C's international community of Web experts.

- SOCIETIES position has been brought to OpenSocial & W3C Joint Workshop about "The future of business", which was held in San Francisco (CA, USA) on 2013, August, 8th and 9th. (190)

Plans for Sustainability and Business Models

The vision of SOCIETIES is to bring the pervasive and social worlds together, using the concept of community. In order to verify this is viable proposition, one of the tasks was to prepare a business canvas for SOCIETIES. This highlighted new business value propositions and business opportunities for the specified stakeholders.

When examining the identified business value propositions we observed that they basically extend existing business models. To make sure that the new and existing stakeholders that were identified are able to act on the revenue streams, we defined a set of business requirements on their behalf. The business requirements and stakeholders list were used as input to the development of the SOCIETIES platform to ensure that it is compliant to the stakeholders' needs.

Based on this work, the SOCIETIES consortium industrial partners will use the expertise and work performed to leverage existing and future products. For the academic partners the work will be associated to Graduate, Master and Ph.D. theses, and the acquired knowledge will benefit their lecturing activities.

Links

Project start date: 1st November 2010.

Project end date: 29th April 2014

Project website: www.ict-societies.eu

Facebook page: http://www.facebook.com/ICTSOCIETIES

Open Source page: http://www.ict-societies.eu/open-source

Deliverables: http://www.ict-societies.eu/project-deliverables

Call 8, Objective 1.2 - Cloud Computing, Internet of Services and Advanced Software Engineering

ARTIST - an end-to-end assisted migration solution for non-cloud software

Clara Pezuela, ATOS & Leire Orue-Echevarría, Tecnalia

Focus Area

For owners and developers of non-cloud software applications, ARTIST offers a set of methods and tools which provide an end-to-end and assisted migration service to transform non-cloud software applications to run on cloud and take full advantage of cloud features. In addition ARTIST provides pre-analysis of migration feasibility, analyzing the software to gauge complexity, and to indicate cost and predict complications based on historical data. This data informs the customer's investment decision. ARTIST also assists during the whole migration process, generating first the model high level view of the original code, optimizing at model level the code in order to introduce such cloud features absent in the original code and generating the newly migrated software. Following migration, ARTIST carries out validation and certification of migrated software and its functionality. ARTIST has produced a first version of the migration methodology, the first prototypes for all supporting tools in technical/business feasibility, model discovery, cloudification of software, code generation and validation of migrated code. And additionally, first versions of certification model and software artefacts repository are also available.

Relevance to the EC Cloud Computing Strategy

As stated in the EC Cloud Computing Strategy, public authorities have a key role in the uptake of trusted cloud environments in the EU, as they can be prescribers of certification models. The ARTIST certification model has been created as a mean to generating a trusted cloud computing framework for service providers and public administrations. The ARTIST certification model focuses on organisations that develop and offer software based services using methodologies and business models that are connected to the Future Internet. Certification is a way to ensure that standard-based products are implemented. The advantages afforded by a certification are: quality products, competitive markets with more choices, commodity pricing, and less opportunity to become "locked in" to a particular vendor. Moreover, a certification program based on well understood and sound principles will be acceptable and credible to its community of users, following the principles outlined in the European Digital Agenda.

Relevant Standards for Interoperability and Portability

As stated by EC in the "Standards and Standardization Handbook", from the point of view of RTD, standards are one of the most important means used to bring new technologies to the market. By transferring research findings into guidance documents, standards provide a bridge connecting research to industry. This connectivity is critical to successful commercialisation. ARTIST assets and tools are being developed with this in mind and all the tools are being based on current standards such as OMG UML2, SPEM2.0, KDM, fUML, ISO27000 series, OASIS TOSCA and the upcoming ISO Cloud Computing Reference Architecture and best practices such as ITIL. ARTIST is building a CloudML upon REMICS's Cloud Modelling Language with the main aim of modelling the most important characteristics of platform providers from the infrastructure point of view and the application point of view, in order to foster easier portability of the application from one platform to another. ARTIST partners are active members of OMG and ISO JT/SC38.

Plans for Sustainability and Business Models

Based on a combination of standard business strategy tools (particularly value chain analysis [1]), a recently described approach to identifying business models [2], and the relatively new Osterwalder business model canvas, the ARTIST project has identified several possible business models around the proposed solution. Most relevant to mention are:

- Standalone consultancy services
    - Assisting non-cloud software owners in the migration assessment
    - Providing a validation and certification service after migration
    - Performing legacy software analysis
- Migration execution scenarios, providing a full migration service to the customer who outsource it to an external provider
- Ancillary services such as providing the methodology and supporting tools for free and as open source and charge for the support, consultancy and training services.

The ancillary services could offer a reusable artefacts (models and transformations) marketplace and sell those artefacts to third parties for migrating their applications. Finally, a very interesting scenario would be to provide ARTIST solution as a complementary offering to cloud providers, attracting customers that are not in the cloud by providing them the required tools for modernising their applications and then make them available to run in the *their* cloud.

In summary, ARTIST provides an entirely open solution to afford the software migration to the cloud from a holistic perspective (technical, business and organizational) and guided from the early stages (when decision is taken) up to final steps (when migrated software is certified).

Links

Website - www.artist-project.eu

Current publication list - http://www.artist-project.eu/publications

References

[1] Porter, M.E. (1979) "How Competitive Forces Shape Strategy", Harvard Business Review, March/April 1979;

[1] Porter, M.E. (1980) Competitive Strategy, Free Press, New York, 1980; Porter, M.E. (1987) "From Competitive Advantage to Corporate Strategy", Harvard Business Review, May/June 1987, pp 43–59;

[1] Baron, D. P., (1995), "The nonmarket strategy system", Sloan Management Review; October 1995; Andrew Feller, Dan Shunk, & Tom Callarman (2006). BPTrends, March 2006 - Value Chains Vs. Supply Chains;

[2] Field, D., (2011) "Describing and Identifying Business Models from Generic Value Chains for Technology Systems" eChallenges e-2011 Conference Proceedings, Paul Cunningham and Miriam Cunningham (Eds), IIMC International Information Management Corporation Ltd 2011, ISBN 978-1-905824-27-4, ISBN: 978-1-905824-27-4;

[2] Field, D. (2011) “Identification of business models through value chain analysis” Self-published

BETaaS - Building the Environment for the Things as a Service

Luca Cucchi, Nicola Valdambrini, Novella Buonaccorsi, INTECS

Focus Area

Today there are countless devices at work to improve productivity and quality of life of human beings, in all technological domains. Each device mainly works in isolation or with very little collaboration and usually for a well-defined specific purpose leading to sub-optimal solutions.

BETaaS offers a solution based on a platform for the execution of content-centric M2M applications, which is built on top of services deployed in a local cloud. The proposed platform seamlessly integrates existing heterogeneous M2M systems and allows to access things as a service transparently regardless of their location in the network.

BETaaS is providing a new vision on the way to expose and manage things in the Internet of Everything environment. It exposes all the services that can be accessed easily by those applications requiring certain functionalities while allowing them to provide the data they generate as content.

Relevance to the EC Cloud Computing Strategy

The BETaaS project aims to define an open platform able to host a wide variety of M2M applications. This is achieved in several ways. First of all the platform will allow plugging-in of third-party adapters in order to use a potentially unlimited set of devices. It then comes natural the development of standard-based adapters to link the platform to common devices, also considering the current evolution of the IoT (an ETSI plugin is indeed part of demo scenarios). BETaaS also contains the logic and ontology definition that allow to abstract from devices and make semantic requests (unaware of the actual used sensors/actuators). On the other side, M2M applications access BETaaS through standard interfaces (e.g SOAP) and negotiate their requirements through standard protocol implementations (i.e. WSAG4J). The abstraction from the physical layer together with the standard interfaces toward applications, is a key point that allow BETaaS to be used by a wide range of applications. Furthermore, its distributed nature together with capabilities like virtualization, trust and Quality of Service management, make it scalable and suitable to contribute to the Cloud technology expansion in several scenarios, from smart cities to home automation.

Relevant Standards for Interoperability and Portability

The BETaaS platform can leverage standards such as:

- ETSI, to allow interoperability of heterogeneous M2M systems/applications
- OCCI (Open Cloud Computing Interface) that defines the entities and relationships in a cloud model and provides an high level protocol to manage resources. In the BETaaS context resources are represented by devices (sensors/actuators)
- WSAG4J, an implementation of the OGF WS-Agreement standard, to manage the negotiation of M2M application requirements

The BETaaS Consortium takes advantage of some partners' direct experience on standardization. Specifically AAU (Aalborg University) contributed to IoT-GSI (Global Standard Initiative) with requirements, recommendations, and functional IoT architectures. It also participated in the Focus Group on Cloud Computing (FG Cloud) at ITU-T (International Telecommunication Union – Telecommunication Standardization Bureau). Intecs participated as an ETSI member to the M2M technical committee.

Plans for Sustainability and Business Models

The BETaaS consortium has followed a tried and tested approach for defining the exploitation options in the project. The process is based on a combination of standard business strategy tools (Value Chain and SWOT analysis) and more recent tools to identify business models (Osterwalder Business Model Generation Canvas1 and Problem vs. Solution Approach).

After a deep market analysis in order to provide the vision of the market, the consortium has also identified commercial and non-commercial sustainability possibilities for the future:

- Non-commercial exploitation is mostly carried out by universities and research centres. Besides advances made in the State of the Art, this type of action is also important since it aims at increasing visibility of research results, identifying the resulting open research questions, and improving teaching standards, providing new lines of research, best practice guidelines, knowledge transfer and conceptual results for all members of the consortium and the scientific community.
- Commercial exploitation would transfer research results into new products and services, using research results in order to improve existing services or generating new commercially exploitable ones, both individually and as a collective.

Links

Website - www.betaas.eu/index.html

References

Project Start and end dates: 01/09/2012 –31/03/2015

Publications:

G. Tanganelli, E. Mingozzi, C. Vallati, C. Cicconetti, "A Distributed Architecture for Discovery and Access in the Internet of Things". [Demo] IEEE Infocom 2013, The 32nd IEEE International Conference on Computer Communications. April 14-19, 2013 - Turin, Italy

E. Mingozzi, G. Tanganelli, C. Vallati, V. Di Gregorio, "An Open Framework for Accessing Things as a Service" in Proceedings of the 16th International Symposium on Wireless Personal Multimedia Communications (WPMC 2013), Atlantic City, NJ, USA, June 24-27, 2013.

Francisco Javier Nieto, "An Architecture for a Platform Providing Things As A Service" in Proceedings of the 16th International Symposium on Wireless Personal Multimedia Communications (WPMC 2013), Atlantic City, NJ, USA, June 24-27, 2013.

1 "Business Model Generation", A. Osterwalder, Yves Pigneur, Alan Smith, and 470 practitioners from 45 countries, 2010

Conferences and Workshops:

Event title	Event type	Organizer	Description	Location	Dates
IoT CoAP Plugtests™ & Workshop	Workshop	ETSI	Building the Environment for the Things as a Service. Presentation of the Project	Sophia Antipolis, FR	November 27, 2012
INFOCOM 2013	Demo	IEEE	A Distributed Architecture for Discovery and Access in the Internet of Things	Turin, IT	April 14 – 19, 2013
Pre-FIA Future Internet Assembly	Workshop	SANDS fp7 project	Workshop Title: Social Things. Presentation of two talks: -Things as a Service - Distributed Services in a IoT local cloud of Smart Things	Dublin, IRE	May 7, 2013
IoT-SOS 2013	Workshop	University of Pisa (Italy), University of Aveiro (Portugal)	Second edition on the workshop on the Internet of Things, Smart Objects and Services	Madrid, ES	June 4, 2013
Global Wireless Summit 2013	Conference	CTIF, Aalborg University, Niksun Princeton University, NICT, YRP, GISFI	BETaaS Special Session with title: "M2M applications — Trends & Challenges" The speakers were both from the project and outside: "A WSN Architecture Design for Fast Moving Objects Tracking", Cosimo Stallo, Andrea Coluccia, Giovanni Savarese, Manuela Vaser, Marina Ruggieri, Ugo Stocco "A Software Defined Networking-based Context-Aware Framework Combining 4G Cellular Networks with M2M", G. Savarese, M. Vaser, M. Ruggieri "Cognitive Radio Inspired M2M Communications", Elias Z. Tragos, Vangelis Angelakis "Scenarios and Applications in a Things as a Service Environment", Sofoklis Kyriazakos, Francisco Javier Nieto	Atlantic City, US	June 24 – 27, 2013

Event title	Event type	Organizer	Description	Location	Dates
			"An Open Framework for Accessing Things as a Service", E. Mingozzi, G. Tanganelli, C. Vallati, V. Di Gregorio "An Architecture for a Platform Providing Things As A Service", Francisco Javier Nieto		
4th ETSI M2M Workshop 2013	Workshop	ETSI	BETaaS: Building the Environment for the Things as a Service Poster presentation of the project	Mandelieu, FR	5-7 November, 2013

BIGFOOT - Big Data Analytics of Digital Footprints

Pietro Michiardi & Marko Vukolic, EURECOM

Focus Area

The BigFoot project, launched in the last quarter of 2012, represents a 3-year engagement to design and implement an all-in-one, optimized and efficient solution to the storage and analysis of large volumes of data. Using existing technologies (e.g., Hadoop and Spark) and new open-source projects (e.g., NoDB), Bigfoot targets automatic and self-tuned deployments of storage and processing engines, enriched by several components aimed at optimizing operations and at an efficient resource utilization (OpenStack).

The foundations of BigFoot are to be found in server and network virtualization, which allow designing and optimally deploying analytics-as-a-service components, including storage and processing engines. BigFoot targets analytics tasks that are both delay-tolerant and latency sensitive by blending together both parallel processing frameworks and distributed databases. For such engines novel mechanisms to address efficient resource allocation are put in place. The BigFoot system exposes standard APIs for data scientists to design and execute their analytics tasks: this is showcased with two application domains, namely IT Security and SmartGrid data.

In the first half of the project, we delivered tools for the automatic (but not yet self-tuned) deployment of analytics-as-a-service components. We defined interfaces and algorithms for the design and implementation of dynamically self-tuned deployments, which exploit continuous monitoring information of the underlying cloud operating system conditions. At the storage layer, we have proposed novel replication primitives for cross-datacenter deployments and novel indexing techniques for modern storage hardware. At the processing layer, we defined and implemented new, size-based resource allocation mechanisms that allow better resource utilization, fairness and performance. In addition, we designed the architecture of a system that allows drastic reductions in the time required to load data into a database. Finally, we proposed and analyzed several algorithms for the classification of security and energy related data, and for the forecasting of power consumption based on historical smart-meter data using regression analysis.

Relevance to the EC Cloud Computing Strategy

In the context of cloud computing, BigFoot contributes to the definition of novel mechanisms for the automatic and self tuned deployment of analytics-as-a-service components. In the context of Big Data, BigFoot contributes with a new system design that unifies parallel processing and database systems. Such efforts materialize both in open-source projects (e.g. OpenStack and Hadoop) and in research articles and prototypes.

Relevant Standards for Interoperability and Portability

The main standard the project might consider (although not actively) is the Cloud Formation Standard: http://aws.amazon.com/documentation/cloudformation/

Plans for Sustainability and Business Models

Currently, the possible business models of the project have yet to be defined. Current deliverables on the topic cover mostly a continuous monitoring of the market of Big Data and Cloud Computing solutions, and their conjunction. Future plans of spin-offs will be addressed in the last year of the project.

Links

Website - www.bigfootproject.eu

Publication list - http://bigfootproject.eu/research.html

Open-Source repositories -

https://bitbucket.org/bigfootproject/

https://github.com/bigfootproject/

Broker@Cloud - Enabling Continuous Quality Assurance and Optimization in Future Enterprise Cloud Service Brokers

Andreas Friesen, SAP; Panagiotis Gouvas & Kahina Hamadache, SingularLogic

Focus Area

Broker@Cloud aims to deliver a brokerage framework which will allow Cloud intermediaries to equip their platforms with advanced methods and mechanisms for continuous quality assurance and optimization of software-based enterprise Cloud services. As enterprises increasingly adopt the model of Cloud Computing, they transform their IT environment into a matrix of interwoven infrastructures. In order to overcome this complexity, future enterprise Cloud service delivery platforms will need to implement a wide array of sophisticated brokerage-enabling capabilities, which will give rise to services that go far beyond anything currently offered by today's Cloud intermediaries.

Relevance to the EC Cloud Computing Strategy

The EC Cloud Computing Strategy is designed to speed up and increase the use of Cloud Computing across all economic sectors. This strategy includes three key actions: a) Safe and Fair Contract Terms and Conditions, b) Cutting through the Jungle of Standards and c) Establishing a European Cloud Partnership. Broker@Cloud concretely addresses all these three key aspects. Regarding (a) Broker@Cloud will deliver a framework which will undertake contract and certification management that spans across the lifecycle of a Cloud Service, i.e. Service Engineering, Service OnBoarding, Service Operation, Service Evolution and Service De-Provisioning. Regarding (b) Broker@Cloud will rely on the Unified Service Description Language (USDL) in order to describe all models (contracts, SLAs, etc.) that are used in the framework of the project's reference architecture. Finally, regarding (c) the project bridges the industrial and the research ecosystems through the demonstration of the developed technology on two platforms that have been developed by large independent software vendors.

Relevant Standards for Interoperability and Portability

Broker@Cloud emphasizes brokerage mechanisms that target continuous quality assurance and optimization. Therefore undoubtedly the key area in the Cloud landscape that is considered by the project, as far as standardization is concerned, is Cloud Service Modelling. In this area, the project intends to capitalize on the effort that have already been invested into the development of USDL (Unified Service Description Language) and its successor Linked USDL in order to leverage results from several past and on-going projects (http://www.linked-usdl.org/). From this perspective Broker@Cloud will invest in the creation of extensions of USDL. The consortium will contribute to these efforts by delivering specific language/method/tool extensions necessary to support the continuous quality assurance and optimization capabilities sought by the project.

Plans for Sustainability and Business Models

The outcome of Broker@Cloud will not be a monolithic framework. Hence its real value lies in its different exploitation assets. Such indicative assets include failure prevention mechanisms, optimization mechanisms, etc. Given the different natures of these assets, it is foreseeable that some of them should be released with different exploitation and licensing models. The consortium is in the process of identifying the exploitation assets and evaluating feedback from potential customers regarding their adoption. The different licensing and business models currently used in the IT world are often relatively complex and can be extremely frustrating for consumers, hence we argue that the final licence and business models used for

the resulting framework should be influenced by the expectations and interests of consumers. This implies that beyond the refinement of assets during gradual consumer exposure, the most efficient (and profitable) marketing schemes should be identified using consumer feedback, comments and interactions.

Links

Website - http://www.broker-cloud.eu

Publications - http://www.broker-cloud.eu/documents

CELAR - Automatic, Multi-Grained Elasticity-Provisioning for the Cloud

Ioannis Konstantinou, Dimitrios Tsoumakos and Nectarios Koziris, ATHENA/IMIS

Focus Area

CELAR's [1] primary goal is to provide elastic resource management for cloud Applications in an automated and fully customizable manner. The outcome of the project will be a set of open-source tools for the complete software stack that will allow the enhancement of a platform towards intelligent and automatic resource provisioning according to the needs of application users.

The project has so far achieved its goals as described in its workplan. The consortium has so far set the foundations for a functional, efficient and fully customizable CELAR System. This will be a novel elasticity-provisioning system architecture, module design and development along three axes (elasticity, monitoring and application management). It will be open-source, and integrated with two IaaS providers (~Okeanos and Flexiant's Flexiscale). The project's progress has been described in 3 scientific papers [2-4].

Relevance to the EC Cloud Computing Strategy

CELAR is in full agreement with the EU Cloud strategy [5]. Firstly, the developed system supports well-defined and commonly used cloud APIs, enhancing interoperability. CELAR's deployment over two different cloud providers, GRNET's ~Okeanos and Flexiant's Flexiscale, along with the provisioning of a single downloadable package demonstrates its capability to support different platforms. CELAR also adopts the open-source, TOSCA [6] specification to describe the provision, deployment and re-contextualization of elastic applications across different Cloud infrastructures. By enabling applications to elastically scale their resources according to the observed demand, CELAR enables application developers to implement strategies to meet complex Service Level Agreements. Users can set arbitrary scaling policies by taking into account both application and/or infrastructure performance metrics. CELAR's enhancement of ~Okeanos [7], GRNET's public cloud service offered to the Greek academic and public sector, strengthens Europe's Public Sector with innovative features, thus enabling its growth.

Relevant Standards for Interoperability and Portability

CELAR utilizes TOSCA [6] for job submission and configuration over different cloud management platforms in order to support application description and submission. The TOSCA specification provides an interoperable description of applications, the relationships between their various components and the operational behaviour of these components, across different, heterogeneous, Cloud infrastructures. The TOSCA specification is extended to define elasticity requirements descriptions, which will be processed and enforced by CELAR's decision module during elastic scaling.

CELAR utilizes standards for cloud IaaS management i.e., the commands to acquire resources from an IaaS cloud provider. CELAR utilizes the OpenStack API [8] and cloud connector libraries using JClouds [9] and libcloud [10] are being implemented

Plans for Sustainability and Business Models

CELARoffers features that both application developers (i.e., IaaS cloud users) and IaaS providers find very attractive. New products in this area, including but not limited to Amazon Autoscaling [11], Jelastic [12], Scalr [13], etc, along with the financial success of the companies that offer them, show that Cloud Elasticity is an active area with potential customers. As the CELAR system and individual modules (offered as open-source) mature, user engagement and increased dissemination efforts will foster its adaptation.

Relative to the sustainability of the offered product, the consortium partners have strong and long interest in their respective areas. Adequate resources including the necessary infrastructure, will be available after the end of the projects to ensure the following:

- Availability of the source code
- Guidance and structures to allow people to extend and contribute to the work
- Maintenance and update of tools related to the CELAR project (website, mailing lists, social sites, version control for code management and issue tracker)

References

[1] Celar ICT-317790: http://www.celarcloud.eu/ Project start: 10/2012 Project end: 9/2015

[2] Tsoumakos, D., Konstantinou, I., Boumpouka, C., Sioutas, S., & Koziris, N. (2013, May). Automated, Elastic Resource Provisioning for NoSQL Clusters Using TIRAMOLA. In Cluster, Cloud and Grid Computing (CCGrid), 2013 13th IEEE/ACM International Symposium on (pp. 34-41). IEEE.

[3] Copil, G., Moldovan, D., Truong, H. L., & Dustdar, S. (2013, May). Sybl: an extensible language for controlling elasticity in cloud applications. In Cluster, Cloud and Grid Computing (CCGrid), 2013 13th IEEE/ACM International Symposium on (pp. 112-119). IEEE.

[4] Gambi, A., Moldovan, D., Copil, G., Truong, H. L., & Dustdar, S. (2013, May). On estimating actuation delays in elastic computing systems. In Software Engineering for Adaptive and Self-Managing Systems (SEAMS), 2013 ICSE Workshop on (pp. 33-42). IEEE.

[5] European Cloud Computing Strategy http://ec.europa.eu/digital-agenda/en/european-cloud-computing-strategy

[6] Binz, T., Breiter, G., Leyman, F., & Spatzier, T. (2012). Portable Cloud Services Using TOSCA. IEEE Internet Computing, 16(3).

CloudScale – Scalability Management for Cloud Computing

Richard Sanders, SINTEF

Focus Area

The goal of the CloudScale project is to aid service providers in analysing, predicting and resolving scalability issues of cloud-aware systems. The project provides an engineering approach for building scalable, elastic and efficient cloud applications and services.

Relevance to the EC Cloud Computing Strategy

Scalability is not specifically mentioned in the strategy; however, CloudScale provides tools and methods supporting inherently massively scalable services architectures, enabling the European industry, including SMEs, to gain an advantage when developing services for cloud computing environments. The project also supports migration scenarios, which facilitates the desired adoption of cloud computing.

Relevant Standards for Interoperability and Portability

CloudScale is a Standard Performance Evaluation Corporation (SPEC) member and participates in the SPEC Research Group Cloud Working Group. The project aims towards standardisation of the description language ScaleDL, and are considering UML MARTE to that end.

Plans for Sustainability and Business Models

Industrial exploitation plans include:

- Building massively scalable applications and services following the engineering approach.
- Consulting services for building scalable applications for different cloud platforms.
- Resolving scalability problems in existing applications in a timely manner. This is relevant for applications developed by partners. Additionally, partners can offer consulting services to other companies facing similar problems.
- Reducing risks for building cloud applications and services.
- Extending existing performance and scalability training courses with the methods developed.

Links

Project website: *www.cloudscale-project.eu*

Project start date: *Oct 2012*

Project end date: *Sept 2015*

Published papers:

- "CloudScale: Scalability Management for Cloud Systems" (IPCE'13)
- Architectural Templates: Engineering Scalable SaaS Applications Based on Architectural Styles (MODELS'13)

For complete publication list: see www.cloudscale-project.eu/publications/academic-publication/

Cloudspaces - Open Service Platform for the Next Generation of Personal clouds

Pedro García-López and Ivan Utgé-Hernández

Focus Area

In the following years, users will access their data from a variety of devices, operating systems and applications. The CloudSpaces project advocates for a paradigm shift from application-centric to person-centric models where users will retake the control of their information. CloudSpaces aims to create the next generation of open Personal Clouds using three main building blocks:

1. CloudSpaces Share that will deal with interoperability and privacy issues.
2. CloudSpaces Storage that takes care of scalable data management of heterogeneous storage resources.
3. CloudSpaces Services that provides a high level service infrastructure for third-party applications that can benefit from the Personal Cloud model.

The CloudSpaces project's main outcome will be StackSync: an open-source Personal Cloud on top of which we will implement and validate the different contributions devised. Moreover, we will also contribute to two current open-source solutions: Ubuntu One and EyeOS. We will use Ubuntu One and StackSync to define an interoperability specification to allow heterogeneous Personal Clouds to share resources with each other. EyeOS will be the proof-of-concept application that will demonstrate the potential capabilities of the CloudSpaces Service platform.

Relevance to the EC Cloud Computing Strategy

The Cloudspaces project will focus on security, scalability and openness, which are two big issues that cloud technology must face in the following years.

Regarding security issues, StackSync will provide zero information to the cloud provider thanks to encryption technologies. All information sent to the cloud (metadata and contents) is protected by symmetric keys only known by the user. In addition, StackSync will provide a privacy-aware sharing component that can work on top of existing cloud platforms (e.g. as a third party app) or can be integrated within existing cloud infrastructures. The goal of this component is to give the end-user indicators about the risk that is posed by sharing particular data items in particular contexts, and also propose and implement policies that they can adopt for mitigating that risk.

StackSync is based on advanced synchronization technology with data optimization that allows it to scale to thousands of users with an efficient use of cloud resources. Academic institutions can't afford the migration of their TBs of data to the cloud, because of the cloud providers' costs. StackSync will overcome this by providing them with hybrid or private cloud solutions that ease this big data migration, and educe their IT infrastructure budget, thanks to the efficiency of the Open Stack cloud infrastructure.

As an open source project based on Open Stack Swift, there is a big community that will benefit from StackSync features. The project is also open to third-party integrations with IaaS providers or software providers. This will help organizations face the key concerns impeding their adoption of the cloud.

Relevant Standards for Interoperability and Portability

In order to avoid vendor lock-in and facilitate information sharing between different services, StackSync lets different Personal Clouds share and access information located in different cloud providers by using

our open APIs. StackSync is also open to the community, as an open source project (www.stacksync.org) so third-party applications can use our APIs to integrate their services on top of StackSync.

In the context of the FP7 Cloudspaces project, Canonical LTD is integrating UbuntuOne with StackSync. StackSync will benefit by getting feedback from the UbuntuOne community, which has millions of users. This would be the first horizontal interoperability scenario between different Personal Clouds. As a vertical interoperability scenario, eyeOS is also integrating its own operating system in the cloud with StackSync, so they can benefit from a scalable, open and secure Personal Cloud.

Plans for Sustainability and Business Models

As a main outcome of the Cloudspaces project, the open source StackSync Personal Cloud will build a community to maintain the product. Furthermore, several infrastructure providers like TISSAT will commercialize the product and guarantee its future evolution in the market. There are four groups that StackSync will focus in its marketing strategy: Infrastructure providers, Software providers, SMEs and Public Institutions.

StackSync could help IaaS providers to deploy an enterprise Personal Cloud for thousands of users at low cost (based on Open Stack Swift). They will be able to update their services portfolio and engage customers with a Personal Cloud specially designed for organizations. We already have three providers interested in this solution: TISSAT, Alsys, and RedIris.

Software providers could take advantage of cloud storage features and bundle their software with a Personal Cloud (StackSync) focused on the organization's needs: security, scalability and openness. A partner of the project (eyeOS) plans to commercialize StackSync with their product.

StackSync also proposes two deployment scenarios focused on SMEs in order to boost their storage in the cloud: StackSync-P (private cloud, that can be deployed on-premise) and StackSync-H (hybrid cloud, that keeps metadata on-premise and stores encrypted raw data on public clouds). Companies like Idiada are studying StackSync as a candidate for their private storage Personal Cloud.

Finally, StackSync could keep citizens data in a cloud storage platform that would let public institutions manage this information without breaches in their data security, or big investments in IT infrastructure. In this line, several Spanish Universities, schools, and cities are beginning to study StackSync as a candidate solution for initial prototypes.

Links

FP7 Cloudspaces (Oct-2012 to Sept-2015)

Website - http://www.cloudspaces.eu

Twitter – http://twitter.com/cloudspaces

StackSync project website - www.stacksync.com and www.stacksync.org

Research Papers - http://cloudspaces.eu/publications

COMPOSE - Collaborative Open Market to Place Objects at your Service

Benny Mandler, IBM Research Haifa

Focus Area

COMPOSE aims at creating a platform to ease the creation of Internet-of-Things (IoT) based services and applications. The envisioned ecosystem includes a developer portal, an IoT ingestion layer, and a full suite of supporting middleware for deploying, hosting, and managing innovative applications in a secure manner. The resulting requirements, architecture, and reference platform are being driven and validated by three pilots: smart space (shopping), smart city (transportation and environment), and smart territory (sports and tourism).

At the end of its first year COMPOSE released a first version of the overall architecture, and has several demonstrations available, including data management, services discovery, scalable communication, and an initial prototype of the smart spaces pilot.

Relevance to the EC Cloud Computing Strategy

COMPOSE is about unleashing the full potential behind the Internet-of-Things by levelling the playing field and opening it up for SMEs and entrepreneurs to create their own IoT-based innovative applications using the COMPOSE platform as their backbone for the creation and the deployment of their applications. The supporting middleware is comprised of all the internal services required for such a platform to be viable, and is manifested as an IoT customized cloud environment. Thus, COMPOSE supports the utilisation of cloud technologies to drive innovation and growth from the public sector.

COMPOSE takes a fresh look at security within a cloud environment, with an emphasis on data ownership, associated polices, and provenance. The COMPOSE cloud environment and platform is built as an open environment, adhering to available standards and works towards establishing new standards where needed.

Relevant Standards for Interoperability and Portability

COMPOSE stresses open standards and views it as an important ingredient in paving the way for its technology adoption roadmap. W3C is a member of the consortium and drives standardisation related efforts. Several potential areas have been identified and will be discussed in pre-standardisation activities aimed at consolidating wider points of view and support.

Among these areas are:

1. Semantic interoperability - semantics as a key capability enabling an open market of smart objects and services.
2. Security, trust and privacy - authentication, provenance, access control and privacy policies.
3. Protocols and APIs - communication technologies, protocols and APIs that should be homogenized potentially across standardisation bodies.
4. Apps and Services interoperability - underlying languages used, including interface definitions.

COMPOSE fosters interoperability by maintaining a query-enabled services registry, with enhanced sematic descriptions, including services description, inputs / outputs, capabilities, as well as grounding information.

Plans for Sustainability and Business Models

The sustainability and longer term business models considered by the project is a two stages approach. At the initial stage, an open source strategy is being devised in which project components are being mapped

along with their respective plans towards open source and appropriate licenses. It is foreseen that most major platform components will be released to the community as open source, and a training plan to foster community around the components and the platform has been put in place. The longer term plans call for a Platform as a Service (PaaS) release with a marketplace that developers and end-users will be able to make use of selected COMPOSE services on a "pay per use" basis.

Links

Website - http://www.compose-project.eu/

LEADS – Large Scale Elastic Architecture for Data-as-a-Service

Anja Strunk, AoTerra GmbH

Focus Area

The digital world provides a wealth of publicly available data that can be exploited by companies in various business domains. However, storing, processing, and querying such amounts of data requires a complex and expensive infrastructure. Small companies or companies without a strong background in business analytics may not want to or fail to operate such an infrastructure.

LEADS is developing a decentralized Data-as-a-Service (DaaS) framework providing means to gather, store, and query publicly available data for everyone at low costs. Instead of maintaining data in-house, the objective of LEADS is to store data in a shared infrastructure that runs on a collection of micro-clouds.

Relevance to the EC Cloud Computing Strategy

LEADS Data-as-a-Service (DaaS) framework will enrich cloud computing landscapes in Europe by providing economical access to a wealth of publicly available data. LEADS will provide jobs, increase the European Union's GDP and prepare the ground for a range of value-added services. Companies of any size may access LEADS through standardized interfaces to enjoying major advantages while evaluating publicly available data. Public institutions may use LEADS to query as well as provide evaluations of public concern (e.g., distribution of flu epidemic etc.) to make the public sector more efficient (e.g., eHealth, social care, etc.). LEADS may also serve as a marketplace on which queries and evaluations are conducted on publicly available data and shared with others to enrich the global knowledge.

Relevant Standards for Interoperability and Portability

The LEADS project is based on the premise of cost and time efficiency, which also applies to the project itself. It is reusing well-known open source projects, such as FlaxCrawler[2], Infinispan[3] and Apatar[4] to build its Data-as-a-Service framework. These modules are written in Java ensuring a high portability of the LEADS framework while also saving costs and speeding up development. The use of open source projects in LEADS, and the contribution LEADS will make to them, may help improve these products.

To query the LEADS platform for data two interfaces are available. A simple and intuitive graphical tool supports novice users, whereas advanced users define queries based on a declarative language. The query engine itself provides a REST based API acting as back-end for the user interfaces as well as to integrate LEADS Data-as-a-Service framework into other applications.

Plans for Sustainability and Business Models

LEADS will provide a novel Data-as-a-Service framework that will make storing, processing, and querying public data available to almost every size of business or organization, instead of leaving it to a handful privileged minority. The operation of such a framework will provide a huge value chain of value-added services:

1) Crawling the web will result in an index similar to those of commercial and non-commercial search engines.

[2] http://code.google.com/p/flaxcrawler/

[3] http://infinispan.org/

[4] http://www.apatar.com/

2) Companies may run analyses on top of this index either on their own infrastructure or using the LEADS repository and computing capacities.
3) A Big Data repository could be created that stores the results of customer requests performed on the LEADS platform for re-use.
4) Large analyses of public interest may be run prior to a customer request and can be offered through the Big Data repository.
5) Customers may re-sell their analysis results to others using the LEADS Data-as-a-Service framework as a marketplace.
6) Companies and organizations may also use this market place to sell and buy business relevant data from or to other entities.

Links and References

Website - www.leads-project.eu

Project dates: 10/2012-9/2015

MODAClouds - Support for model-driven engineering of Multi-Clouds services and applications

Elisabetta Di Nitto, Politecnico di Milano & Dana Petcu Institute e-Austria Timisoara and West University of Timisoara

Focus Area

MODAClouds provides methods and technologies for Cloud-based model-driven engineering. These include a decision support system, an open source IDE and a run-time environment. These will allow high-level design, early prototyping, semi-automatic code generation, and automatic deployment of applications on Multi-Clouds with guaranteed quality of service. Model-driven development, combined with novel model-driven risk analysis and quality prediction, is enabling developers to specify Cloud-provider independent models enriched with quality parameters, implement these, perform quality prediction, monitor applications at run-time and optimize them based on the feedback, thus filling the gap between design and run-time. In the next development phase, MODAClouds will provide techniques for data mapping and synchronization among multiple Clouds.

Relevance to the EC Cloud Computing Strategy

MODAClouds addresses Key Action 1 of the EC Cloud Computing Strategy (Cutting through the Jungle of Standards). It helps avoid the problem of lock-in by offering an abstract view of the Cloud services at design, deployment and run-time, through the model-driven architecture that is adopted in its software stack.

Following the requirements of the first sub-action of the Key Action 1, it also promotes trusted and reliable Cloud offerings, by proposing a set of software engineering tools that help:

i) Software analysts assess the risk of software stacks migration towards Clouds

ii) Software developers design applications that are agnostic to the Cloud environment

iii) Cloud application and service operators monitor the quality of Cloud services that are consumed and adapt applications to the changes that occur at the level of the Cloud services they exploit.

Relevant Standards for Interoperability and Portability

MODAClouds supports and promotes the adoption of the CloudML proposal as a standard for model-based provisioning and deployment of Cloud-based systems. Moreover, it offers a concrete and enhanced implementation for this standard and tests it on real applications.

In addition, MODAClouds follows the design and early implementation of TOSCA (the OASIS Topology and Orchestration Specification for Cloud Applications) for enhancing the portability and management of Cloud applications and services across their lifecycle and of CAMP (the OASIS Cloud Application Management for Platforms) for standardizing Cloud PaaS management API.

Finally, MODAClouds exploits the Service Measurement Index (SMI) to support its users in assessing the risks and advantages of selecting a certain cloud provider.

Plans for Sustainability and Business Models

At the current early stage of the project, the following business scenarios are investigated:

1. Technology as Open Source to the community: deliver the core results as Open Source Software to the community.
2. Standalone consulting services over Open Source Approach: provide consulting services in using MODAClouds technology and knowledge, customization, installation, service, and support to third party organizations.
3. Technology Out of the Box: sell MODAClouds services (technology and knowledge) to customers to address their identified problems.
4. Recommendation-as-a-Service: refers to MODAClouds' Decision Support System to be offered commercially.
5. MODAClouds-as-a-Service Broker: a new legal entity with the participation of project partners brokers the services of the partners.
6. Scientific Community Influence: use MODAClouds results to create influence on areas related to the project scope advancing the State of The Art and transferring knowledge and assets to the scientific community.

Links and References

Website- www.modaclouds.eu

Period - 1 October 2012 – 30 September 2015

Publications - www.modaclouds.eu/publications/

Software stack - www.modaclouds.eu/software/

OCEAN - Reviewing and mapping open cloud projects

Yury Glickman, Fraunhofer FOKUS

Focus Area

The OCEAN project contributes to the emergence of a sustainable open source cloud ecosystem, focusing on European FP7 and national research projects, and on Japanese cloud initiatives. OCEAN serves the following communities:

- Cloud services builders, integrators and customers benefitting from OCEAN Open Cloud Directory, as a one-stop-shop collecting information about cloud projects and their open licensed results.
- Cloud developers who can use OCEAN quality testing services and cloud reference architecture to map their cloud components, check for complementarities and overlaps.
- Open Cloud project managers who can increase their visibility by providing information about their projects and results to OCEAN Open Cloud Directory, demonstrating results at open cloud forums, during webinars and EU/Japanese collaboration events.

Relevance to the EC Cloud Computing Strategy

Europe as a whole needs projects such as OCEAN to ensure that the European Commission realizes its overarching vision. Only by closing gaps, eliminating overlaps, and avoiding missed opportunities amongst current projects will Europe be able to truly do its best at creating a unique, sustainable open cloud ecosystem. OCEAN develops an online directory of Open Source Software outcomes of cloud projects as one-stop-shop directory for the growing community of Open Cloud projects, builders, integrators and users. OCEAN is now providing a functional mapping of these outcomes in an Open Cloud Interoperability Framework and Roadmap - in relation with a reference architecture and key standards coming from leading standardization organizations such as NIST, ETSI, IEEE, DMTF, OGF, SNIA. OCEAN services are also contributing to build, test and check the quality and the interoperability of important cloud assets, should they come from European clouds, national clouds or Japanese cloud projects.

Relevant Standards for Interoperability and Portability

We have noticed a growing interest regarding CIMI (Cloud Infrastructure Management Interface) and OVF standards from DMTF to provide unified access to multiple clouds. Also CDMI (Cloud Data Management Interface) from SNIA offers a unified management access to cloud storage resources.

Together with ETSI, DMTF, OGF and SNIA, the OCEAN-Project consortium co-organized the first Cloud Interoperability Week in Madrid and Santa Clara, in September 2013[5]. This event provided workshops, hands-on tutorials and a cloud plugfest focused on interoperability testing among different implementations of CAMP, CDMI, CIMI, OCCI and OVF cloud standards.

We are inviting the European FP7 open cloud projects to collaborate through new events and find efficient gateways between cloud projects: OW2 Open Cloud Forums (in London 26-27 February 2014, Paris 9-10 April) and the next OCEAN Cloud Collaboration Workshop (in Brussels 15-16 May 2014) are 3 examples of such events.

[5] http://www.cloudplugfest.org/cloud-interoperability-week

Plans for Sustainability and Business Models

The four partners in the OCEAN project have plans to incorporate OCEAN results into the conduct of their businesses.

- Fraunhofer FOKUS will maintain and develop the Open Cloud Directory together with the Cloud Interoperability Framework to become a centre of competence on latest Open Cloud developments and initiatives.
- For Engineering Ingegneria Informatica SpA, OCEAN represents a great opportunity to promote the use of ETICS tests within EU projects. The ETICS team is integrating new testing and quality verification features.
- OW2 will be able to provide more IT guidance and IT governance services, leveraging OCEAN ETICS results to complement its SQuAT (Software Quality Assurance and Trustworthiness) quality program. The Open Cloud Directory will also help OW2 members find open cloud components and useful information for their own projects.
- IPA recognizes many Japanese companies for seeking new business over cloud infrastructure as potential market. IPA is collecting expertise and contacts to support them.

Links and References

- OCEAN-Project website: http://www.ocean-project.eu
  - Start date / end dates: Oct 2012 / Sept. 2014
  - OCEAN Consortium : Fraunhofer FOKUS, Engineering, OW2, IPA
- Open Cloud Directory: http://www.ocdirectory.org/
- Cloud interoperability week: http://www.ow2.org/view/Events/Cloud_Plugfest
- Cloud Plugfest 2013: https://sites.google.com/a/cloudplugfest.org/welcome/cloud-interoperability-week/cloudplugfest
  Cloud Europe Expo, 26-27 February 2014, London: http://www.cloudexpoeurope.com/
- Open Cloud Forum, 26-27 February 2014, London: http://www.cloudexpoeurope.com/Content/Open-Cloud-Forum
- Cloud Computing World Expo, 9-10 April 2014, Paris: http://www.cloudcomputing-world.com/

CloudScale – Scalability Management for Cloud Computing

Richard Sanders, SINTEF

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Links

Project website: *www.cloudscale-project.eu*

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Published papers:

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- Architectural Templates: Engineering Scalable SaaS Applications Based on Architectural Styles (MODELS'13)

For complete publication list: see www.cloudscale-project.eu/publications/academic-publication/

OSSMETER – Automated Measurement and Analysis of Open Source Software

Scott Hansen, The Open Group & Dimitris Kolovos, University of York

Focus Area

OSSMETER aims to extend the state-of-the-art in the field of automated analysis and measurement of open source software (OSS), and is developing a platform that will support decision makers in the process of discovering, comparing, assessing and monitoring the health, quality, impact and activity of open source software. To achieve this, OSSMETER will compute trustworthy quality indicators by performing advanced analysis and integration of information from diverse sources including the project metadata, source code repositories, communication channels and bug tracking systems of OSS projects. OSSMETER does not aim at building another OSS forge but instead at providing a meta-platform for analysing existing OSS projects that are developed in existing OSS forges and foundations such as SourceForge, Google Code, GitHub, Eclipse, Mozilla and Apache.

The project has to date developed a first implementation of the new platform and is able to analyse projects from selected OSS forges using a combination of language agnostic and language specific metrics, as well as advanced natural language processing (NLP) technologies to evaluate communications content collected from the communities of users and developers surrounding such projects

Relevance to the EC Cloud Computing Strategy

For European users seeking Cloud based open source technologies for use in development of new products and services, the OSSMETER technologies will provide facilities to better identify, assess and compare potential candidate technologies. In particular, customised combinations of metrics and criteria can be easily configured in order to determine candidate OSS technologies that conform to standards and that are responsive and are evolving in line with new or updates to existing recognised industry standards. It's also possible to determine the standards that have had an impact on OSS providers in specific domains, and those that have been largely ignored or have had little impact on existing OSS technologies. These new capabilities contribute to the EC Cloud Computing Strategy by assisting European users to cut through the wide range of Cloud based OSS technology choices and to determine those that best meet the needs of the organisation, while also identifying the standards that are closely tracked within the OSS development communities to confirm which standards are most relevant for use in new products and services.

Relevant Standards for Interoperability and Portability

The project utilises a number of open standards in the area of access protocols for being able to obtain information from Cloud based OSS project forges. In addition, standard protocols such as NNTP published by the IETF are used by the OSSMETER platform to obtain information from communities surrounding OSS projects by analysing Newsgroups and user and developer Forum content. Other standards such as HTTP are used to interface between the back-end platform and the web based client interface along with OSGi, which is used for communications between the different components of the back-end platform. Additional standards utilised for communicating with Cloud based OSS forges include WebDAV (IETF), and several others.

The project itself has developed metamodels for describing and structuring the various types of information that is made available from widely used Cloud based OSS forges. Further investigation as well as industrial validation by industrial partners in the project is needed before a determination can be made

whether to submit the metamodels being developed in the project to a standards making body for industry consensus.

Plans for Sustainability and Business Models

The project is focused on analysis of OSS projects and the results from the project will itself become a new OSS project that can be used within the context of three main business models. The first is the provision of ad supported or fee based commercial analysis services where the new platform can be utilised by a service provider to offer standardised and custom analysis services addressing a wide range of Cloud based OSS projects from multiple OSS forges. A second variation of this model would be a service provider that focuses on providing analysis of Cloud based OSS project for a specific domain, for example the Eclipse community of projects providing tools and technologies for model driven engineering. For example, one of the industrial partners in the project is evaluating the use of the platform for analysing OSS projects related to Cloud based software technologies for building and construction engineering. A third business model focuses on use of the project technologies for internal monitoring of quality of software development projects within an organisation with the new analysis capabilities focused on evaluating internal projects. The project seeks to support each of these business models and establish a community of users, contributors and commercial exploiters interested in the new OSS assessment capabilities, who will contribute to the expansion of the platform technologies to support additional OSS forges and metrics.

Links and References

Project website: www.ossmeter.org

Project start/end: 1 October 2012 / 31 March 2015

Published papers: see www.ossmeter.org/publications

PaaSage - Model based cloud platform upperwear

Keith G Jeffery (scientific coordinator), Lutz Schubert, Geir Horn, Pierre Guisset

Focus Area

Cloud computing is a popular and over-hyped concept in ICT. Infinitely scalable elastic resources changing without complex systems administration and paying only for resources used is attractive. These benefits are not immediately realisable. PaaSage will deliver an open and integrated platform, to support both deployment and design of Cloud applications, together with an accompanying methodology that allows model-based development, configuration, optimisation, and deployment of existing and new applications independently of the existing underlying Cloud infrastructures. Specifically it will deliver a Cloud modelling language, an IDE (Integrated development environment), execution-level mappers and interfaces and a metadata database.

Relevance to the EC Cloud Computing Strategy

The strategy aims at an open market in services for Cloud Computing based on standardisation with SLAs, certification schemes and codes of conduct. Cloud providers still expose their own interfaces, their individual ways of deploying, hosting and managing services. This makes portability of applications difficult and execution across multiple cloud providers an impossibility. Rather than adding further complexity to the scope of existing (and upcoming) standards, the PaaSage project offers an approach orthogonal to this: by allowing the developer to describe his needs, rather than his interfaces, he is able to abstract from the technical details and can concentrate on his core business instead. PaaSage offers the mechanisms to not only map the desired properties to the different host offerings, but also to match the interfaces to support deployment, configuration and execution on a large scope of providers – not only individually, but also jointly. PaaSage spans across SLAs, certification schemes and codes of conduct (as they develop) so users and developers can fully exploit provider offerings making them interoperable and reversible, enabling them to cut through the jungle of standards easily.

Relevant Standards for Interoperability and Portability

The key is to provide virtualised homogeneous deployment over heterogeneous Cloud platforms. This requires that the platforms are virtualised by description in a common language. Similarly the application, the user and the data dependencies require description in order to allow deployment of an instance of the application. CAMEL (Cloud Application Modelling and Execution Language) is being developed in PaaSage as a superset language over several DSLs (Domain Specific Languages) including some existing standards. We expect to standardise CAMEL.

Plans for Sustainability and Business Models

PaaSage is strongly end-user oriented – not only does the project address needs of direct commercial relevance, it will also make sure that all relevant results will be available as open source to the wider community, allowing extensions and adaptations to feed back into the capabilities of PaaSage. The project will use an open development methodology with the aim to gather a developer community to contribute to the project and ensure further enhancements beyond the project's end. The partners' individual exploitation plans are being developed following SEQUOIA exploitation methodology.

Links and References

Project website: www.Paasage.eu or visit twitter.com/paasage

For an up to date list of project papers please visit www.paasage.eu/scientific-publications

The PaaSage project will run from 1/10/12 to 31/9/2016.

PROSE - The PROSE Open Source Software Forge for European Projects

Alfredo Matos, Caixa Magica Software & Miguel Ponce de Leon, Waterford Institute of Technology

Focus Area

PROSE [1] is a Coordination and Support Action (CSA) that promotes the use of Open Source Software in European projects. The project has established a new platform for collaborative software development, Open Source Projects EU [3], that provides the necessary tools for supporting the software development cycle of European projects, including (private or open) software development repositories, communication support, issue management, creating and evaluating open source software. The platform is augmented with training on the legal and business aspects of Free/Libre Open Source Software (FLOSS).

Relevance to the EC Cloud Computing Strategy

PROSE targets Cloud Computing and Internet of Services (IoS) by supporting the uptake of open source development models in Europe by identifying and reducing the barriers for FLOSS adoption within EU projects. Through the creation of the Open Source Projects platform, PROSE provides a sustainable environment for software collaboration and dissemination, capturing input, contributions and results of ICT projects. OpenSourceProjects.eu supports the entire software development cycle, and can sustain the software beyond the projects' completion, increasing the impact and visibility of FP7/H2020 results. Projects can leverage the PROSE platform as means towards disseminating and sharing their results, ensuring that software will persist beyond the lifetime of the project. The platform provides the tools to open software to outside contributions and generate a meaningful community within the FP7/H2020 ecosystem. This provides unparalleled sustainability for project results by facilitating development efforts, direct collaboration and EU ICT software procurement, through an already available source code management platform.

Relevant Standards for Interoperability and Portability

As a CSA, PROSE provides indirect contributions towards standards for Interoperability and portability, by providing a platform that can be used for open collaboration. The use of open source software and methodology can prove to be an invaluable support pillar for designing and establishing widely adopted standards, and a key driver for interoperability implementation, testing and related strategies.

Through the use of the Open Source Projects platform, projects can contribute to open software and open standards, using adequate tools to establish a successful and fruitful collaboration. This includes support for project management, collaboration, and software hosting that are critical towards establishing open collaborations that can aim towards interoperability and portability.

Plans for Sustainability and Business Models

The main PROSE result is an open software forge - Open Source Projects EU- actively maintained and supported by the project. The platform itself will continue to exist beyond the lifetime of the project directly supported by the consortium members, given its relevant value for FP7 and H2020 projects.

To ensure the sustainability of the platform, PROSE is establishing a legal entity that can support, maintain and grow the existing platform through several initiatives:

- Create a (for or non-profit) spin-off entity that can shepherd the platform development
- Secure sponsorship (both private and public) for platform sustainability and development

- Create an adequate business strategy to generate revenues to can support platform growth

The key element of the PROSE platform sustainability plan is to create a spin-off legal entity that can ensure the continuous growth of the valuable project results, and ensure the viability and transition of the platform towards Horizon 2020, and as a FLOSS beacon in the European community.

Links and References

[1] PROSE- Promoting Open Source In European Projects, Project website: http://ict-prose.eu.

[2] A. Matos, M. P. de Leon, R. Ferreira, and J. P. Barraca, "An open source software forge for European projects". Proceedings of the Workshop on Open Source and Design of Communication, OSDOC '13, ACM, pages 41–45, Lisbon, Portugal, 2013.

[3] Open Source Projects EU Platform: http://opensourceprojects.eu

RISCOSS - Risks and Costs in Open Source Software Adoption

David Ameller, Xavier Franch, Angelo Susi, Cedric Thomas

Focus Area

RISCOSS develops both a methodology and a software platform that integrate the whole decision-making chain, from technology criteria to strategic concerns.

RISCOSS's risk management-based methodology facilitates the adoption of open source code into mainstream products and services [1]. The methodology is based on the modelling and analysis of OSS-based ecosystems, the development of statistical assessment and measurement techniques, for the management of risk adapted to the specifics of open source software.

So far the project has delivered a number of methods and techniques including ontologies for OSS ecosystems and risks, catalogues of patterns for modelling OSS ecosystems according to the business strategies adopted, risk-reasoning techniques based on risk models attached to goal-oriented models, etc. They have been integrated into a software system that provides a proof of concept of the RISCOSS platform.

Relevance to the EC Cloud Computing Strategy

Using advanced software engineering techniques and risk management methodologies, RISCOSS develops innovative tools and methods to identify, manage and mitigate risks of integrating third-party open source software. While the RISCOSS project was launched to address issues raised by communication equipment manufacturers looking to integrate open source code into their products, it will be possible to leverage the platform and the associated methodologies to assess cloud software and thus build trust for cloud software platforms.

As open source drives innovation in the cloud – in particular through many open source projects that are financially supported by the national governments and the European Commission, – the RISCOSS platform will provide unparalleled resources to support the dissemination of innovative cloud computing platforms. By bringing sense and analytical value to the pass of raw information that is already available on cloud software, RISCOSS can help develop best practices and transparency in the cloud computing market.

Relevant Standards for Interoperability and Portability

Compliance with open standards ranks quite high in the risk analysis developed by RISCOSS. With regard to cloud computing, the most important interoperability and portability standards that RISCOSS will cover include: DMTF-CIMI [2] and OGF-OCCI for cloud infrastructure management [3], SNIA-CDMI for data management [4], and OVF for virtual application packaging [5]. These standards are open and still evolving. There is also IEEE P2302: Standard for Intercloud Interoperability and Federation (SIIF) a new standard in the works at IEEE that defines topology, functions, and governance for cloud-to-cloud interoperability and federation [6].

Plans for Sustainability and Business Models

According to Gartner, by 2016, open source technologies will be included in 95% of all commercial software packages. And yet, according to SourceForge, the most popular OSS portal, most OSS projects and their adoption have ended in failure: 58% do not move beyond the alpha developmental stage (22% of them remain in the planning phase, while 17% remain in the pre-alpha phase, and some of them become inactive).

There is an undeniable market need for decision-support resources, whether stand alone platforms or on-line services that help users understand the kind of risk they are taking when they decide to integrate an open source component in their products or their information systems.

All use-case partners in the project, TEI, KPA, XWiki, Moodbile, Cenatic and OW2 already have plans to incorporate RISCOSS into the conduct of their businesses. For example, Spain's Cenatic will test RISCOSS in enabling the dissemination of open source solutions in the public sector. XWiki and Moodbile.org, two open source projects, will leverage RISCOSS to enhance the consistency of their user- and community-driven feature roadmaps, and put the focus on reliability, stability and support for backward compatibility. OW2 will leverage RISCOSS to complement its SQuAT (Software Quality Assurance and Trustworthiness) quality program.

Currently, RISCOSS is making the necessary steps to disseminate the product into some communities in order to search for exploitation opportunities. In addition to the value that RISCOSS delivers, these early adopters could benefit by influencing in the future directions of the project.

Links and References

RISCOSS website is http://www.riscoss.eu/. The project started on November 1st, 2012 and ends on October 31st, 2015

[1] Xavier Franch, Angelo Susi, Maria Carmela Annosi, Claudia P. Ayala, Ruediger Glott, Daniel Gross, Ron Kenett, Fabio Mancinelli, Pop Ramsamy, Cedric Thomas, David Ameller, Stijn Bannier, Nili Bergida, Yehuda

Blumenfeld, Olivier Bouzereau, Dolors Costal, Manuel Dominguez, Kirsten Haaland, Lidia López, Mirko Morandini, Alberto Siena: Managing Risk in Open Source Software Adoption. ICSOFT 2013: 258-264

[2] http://www.dmtf.org/standards/cloud

[3] http://occi-wg.org/

[4] http://www.snia.org/cdmi

[5] http://www.dmtf.org/standards/ovf

[6] https://standards.ieee.org/develop/project/2302.html

SUCRE – Supporting Cloud Research Exploitation

Eleni Toli

Focus Area

SUCRE aims to investigate and suggest means for reinforcing the adoption of Open Source Cloud solutions by key stakeholders and particular high-impact communities. The project seeks to identify the impediments to Open Source Clouds being widely adopted. SUCRE will also examine how this adoption can be facilitated through an international dialogue on the "hot" topics of interoperability and data portability involving experts from both the EU and Japan.

Relevance to the EC Cloud Computing Strategy

SUCRE has engaged two user communities whose computing requirements could be served by Open Source Cloud solutions, namely, the public sector and the health care sector. These domains serve as the SUCRE use-cases and are directly addressing main notions of the EC Cloud Computing Strategy, such as "*to speed up and increase the use of cloud computing across all economic sectors*". It is also aligned with the emphasis that is put on the adoption of Cloud solutions by the European Public Sectors. Moreover, through its EU-Japan related activities, SUCRE is in-line with and supports the aims of the International Cooperation strategy and policy of the Digital Strategy.

Relevant Standards for Interoperability and Portability

SUCRE has set up an EU-Japan experts group, composed of prominent stakeholders from both regions. The group primarily discusses issues related to Cloud interoperability, standardisation and data portability and is working to produce a coherent set of recommendations related to the issues above.

Plans for Sustainability and Business Models

SUCRE is a Support Action, and therefore no technical implementations or technical products will be delivered. Nevertheless, the consortium will produce an "End Product" comprising, among others, the following outcomes:

- The four issues of CloudSource Magazine highlighting the most successful case studies in EU and Japan
- The video products addressing user communities, public administrations, SMEs, and industry, in order to showcase the developments in Open Clouds
- High-impact reports, such as the primer documents for the public and healthcare provisioning sectors, and the recommendation report of the EU-Japan expert group

The SUCRE consortium is planning to sustain the activities above, mainly through the maintenance of the SUCRE portal, even after the closing of the project, as well as the network of stakeholders.

Links and References

Call identifier: FP7-ICT-2011-8
Funding scheme: CSA
Start: Oct. 2012
End: Sept. 2014
Duration: 24 Months
SUCRE website: http://www.sucreproject.eu/
Twitter: @SUCRE_project, #SUCRE

www.facebook.com/SUCREproject
www.scoop.it/u/sucre-project
CloudSource Magazine Issue 1 & 2: http://www.sucreproject.eu/content/sucre-cloudsource-magazine
SUCRE video, Cloud Computing in Public administrations: http://www.sucreproject.eu/videos
[5] http://www.dmtf.org/standards/ovf

[6] https://standards.ieee.org/develop/project/2302.html

U-QASAR - Universal Quality Assurance & Control Services for Internet Applications with Volatile Requirements and Contexts

Aitor Elorriaga Elorza, Silvia López, Manuel García

Focus Area

The main objective of U-QASAR is to create a flexible quality assurance, control and measurement framework to quantify the quality of Internet-related software development projects and the resulting products. The framework is composed of a methodology and a solution composed of several knowledge services based on open standards. It will be able to self-adapt to fast changes in scope and requirements, so as to provide an accurate measurement of the quality at any time. Methodology and platform are being validated and assessed in two real business cases that are representative of different software development paradigms. One is an IT company that develops multiple types of applications following different methodologies. This business case is oriented to more traditional development paradigms, such as Rational Unified Process (RUP). The other company develops one single product for manufacturing companies and is focused on agile development.

Relevance to the EC Cloud Computing Strategy

U-QASAR strengthens the software industry in Europe that offers a large choice of services satisfying key societal and economical needs, with reinforced capabilities to engineer and produce software solutions and on-line services. U-QASAR will have a bearing on the quality of existing and new Internet Services and applications, making them more reliable, trustworthy and robust. Thus improving the strength of software-based services industry in Europe. The project will produce an easily accessible solution because of its low cost. Service providers will be able to minimize their development cycles costs and duration by introducing the concept of "early quality". This will lead companies to be more competitive, offering more services at a lower cost and higher quality.

Relevant Standards for Interoperability and Portability

In the last 20 years RTD centres, universities, industry and standardization bodies have made a meaningful effort to create international standards for measuring the quality of the software product and the development process, referring to and making use of all the previous research activities performed in the past. The most relevant standard reference models in Software Product Quality are ISO/IEC 9126:1991 - Software engineering - Product quality. Recently replaced by ISO/IEC 25000; ISO/IEC 14598:1999 - Information technology - Software product evaluation. Also included in ISO/IEC 25000, ISO/IEC 25000:2005 - Software engineering - Software product Quality Requirements and Evaluation (SQuaRE) – Guide to SQuaRE. Many initiatives have arisen to support the evaluation and improvement of the Software Development Process. The main reference models in this domain are ISO/IEC 15939:2007 - Systems and software engineering - Measurement process, or ISO/IEC 15504:2004 - Information technology - Process assessment. All these standards need to be adapted to the special needs of the Cloud Solutions and U-QASAR can contribute in its enhancement.

Plans for Sustainability and Business Models

The aim of the U-QASAR consortium is to exploit the results of the project as a Cloud Service to those software development enterprises oriented to integrate quality assurance activities in their entire software development lifecycle. To do this the consortium is making use of the FP7 project NEFFICS results for the elaboration of the business model. In NEFFICS, C. Lindgren et al [Lindgren, 2008] proposed a model of seven elements (Value Proposition, Target customer, Value Chain, Competences, Networked partners,

Relations and Profit formula) based on the observation of several international novel business models. Other frameworks U-QASAR is taking into consideration are the ones proposed by [Osterwalder, 2010] and [Johnson, 2008].

Links and References

Project URL: http://www.uqasar.eu

Start Date: 01.October.2012

End Date: 30.September.2015

Conferences and Publications:

Event title	Event type	Organizer	Description	Location	Dates
5th International Conference on Intelligent Decision Technologies	Conference	KES International / Uninova	Presentation of research paper "O. Kotte, A. Elorriaga, D. Stokic, S. Scholze, Context Sensitive Solution for Collaborative Decision Making on Quality Assurance in Software Development Processes, Intelligent Decision Technologies, Sesimbra, Portugal, 2013"	Sesimbra, Portugal	6/26-28/2013
Helsinki Software Testing Days 2013	Seminar	Finnish Association of Software Testing and Aalto University	**Poster:** U-QASAR Project was presented at the poster session of the seminar. **Invited talk:** Ingredients of Defect Detection (Juha Itkonen, Mika Mäntylä, Aalto University)	Otaniemi, Espoo, Finland	6/4/2013

Call 10, Objective 1.2 - Software Engineering, Services & Cloud Computing

ASCETiC - Adapting Service lifecycle towards Efficient Clouds

Ana Juan Ferrer, Karim Djemame

Focus Area

The project *Adapting Service lifeCycle towards EfficienT Clouds* (ASCETiC) aims to provide novel methods and tools to help software developers to optimise energy efficiency and minimise the carbon footprint by designing, developing, deploying and running software in Clouds infrastrucutures while maintaining other quality aspects of software to adequate and agreed levels. ASCETiC main objective is to integrate energy efficiency at the same level as other quality aspects during service requirements engineering, design, construction, deployment, and operation, leading to an Energy Efficiency Embedded Service Lifecycle. As a result, ASCETiC will deliver a framework consisting of tools and methods covering each phase of development lifecycle for implementing energy efficient cloud services at the different layers of the cloud computing stack. Furthermore, the applicability of ASCETIC to achieve 20% of energy savings will be demonstrated on two Industry use cases: a compute intensive product life-cycle management system for the building Industry, and a data intensive news asset application.

Relevance to the EC Cloud Computing Strategy

ASCETIC is addresses the "advanced computing architectures and software engineering for the cloud and beyond" theme. Energy efficiency is also at the heart of the EU's Europe 2020 Strategy for smart, sustainable and inclusive growth and of the transition to a resource efficient economy. ASCETiC's outcome is an open source cloud computing stack and its reference implementation for software developers and cloud computing technologists to produce a ubiquitous energy efficient open source cloud computing platform for public and private clouds. ASCETiC aims to deliver solutions for all types of clouds by being simple to implement while supporting energy efficient components at all layers (Software, Platform, and Infrastructure as a Service). Moreover, ASCETiC is addressing challenges that are common to the areas of embedded computing and cloud computing: heterogeneity across the whole computing stack, energy efficiency, performance analysis, parallelisation, virtualisation, and reconfigurability.

Relevant Standards for Interoperability and Portability

ASCETiC is collaborating with a number of standardization bodies and standards-related groups, as well as appling existing standarisation efforts to facilitate interoperability and portability.:

- GreenGrid: on the development of standards for adoption by cloud providers to become more energy efficient in managing their infrastructure and identify methods that lower costs and support global sustainability initiatives.
- COST 804 organisation, IC0804 - Energy efficiency in large scale distributed systems: on standards and complementary approaches (to hardware specific solutions to lower energy consumptions) at the distributed system level, for example middleware and applications.
- ISO: from the software engineering perspective ISO/IEC JTC1-SC7 on Software and Systems Engineering (SSE), and ISO JTC1-SC38 on Distributed Application Platforms and Services (DAPS).
- OGF-OCCI (Open Grid Forum – Open Cloud Computing Interface): on the delivery of APIs specification for remote management of cloud computing infrastructure, allowing for the development of interoperable tools for common tasks including deployment, autonomic scaling and monitoring.
- Distributed Management Task Force (DMTF): on developing specifications for cloud service portability and management consistency across cloud and enterprise platforms, working closely with the Open Cloud Standards Incubator (OCSI) group.

- SNIA-CDMI (Storage Networking Industry Association- Cloud Data Management Interface): on the adoption by the programming model COMPSs of the cloud storage reference implementation and the Green Storage Energy Measurement Specification.

Plans for Sustainability and Business Models

Both Cloud customers and providers recognise the need for methods and tools to determine and optimize the value of each unit of energy spent on IT services. They want to correlate energy consumed to the beneficial work on which that energy is spent to establish a direct relationship between energy consumed by a service, or application, and its delivered benefits. ASCETiC focuses its efforts in providing tools to enable this by considering the complete service life-cycle. Gartner estimates that by 2015 '20% of large organisations will start allocating energy use and costs to specific application workloads'. Increasingly Cloud providers (and private cloud operators) suffer the rise of operational costs, mainly related to energy consumption. These are a continuous upward pressure over the long term, being proportionally higher because of general fall in hardware and software costs. Isolating this cost and correlating it to specific services requires tools to precisely determine, and optimize, energy consumption per service. Based on this approach, ASCETiC will propose new business models and pricing mechanisms for Cloud providers that will take into account energy-efficiency. This is something not currently dealt with by existing service and cloud providers. The ASCETiC methodology for lifecycle software development will enable a new, innovative energy-efficient ecosystem strengthening market competition and creating incentives that will enable the entrance of new players in the Cloud Computing market, especially SMEs.

Links

Project website - http://ascetic-project.eu/

References

Project start date: 01/10/2013

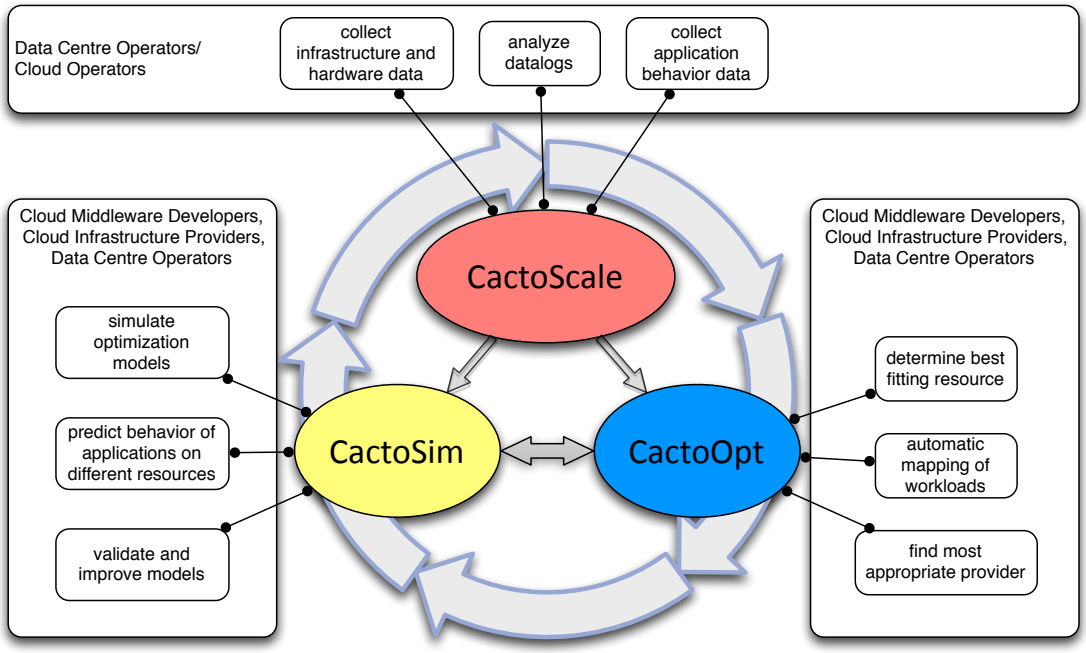
Project end date: 30/09/2016

CACTOS - Context-Aware Cloud Topology Optimization and Simulation

Stefan Wesner, Ulm University; Per-Olov Östberg, Umeå University; Henning Groenda, FZI; James Byrne, DCU; Dimitrios S. Nikolopoulos, QUB; Craig Sheridan, Flexiant; Stephan Rüth, Realtech AG

Focus Area

The vision of the CACTOS project is focused on cloud topology optimization. This is realised by providing new types of data centre optimization and simulation mechanisms. CACTOS is holistic and aims to support both design-time and run-time optimization, covers data acquisition and application profiling as well as infrastructure management. One of the major challenges is how optimization algorithms and concepts can cope with the scale, heterogeneity, and complexity of modern cloud application workloads while providing advanced infrastructure capabilities such as resource elasticity and custom quality of service for applications. The aim of the project is to develop monitoring, simulation, and management tools that accurately capture the dynamics of complex workloads, abstract the heterogeneity of resource sets, and optimize data centre layout and configuration to increase resource and energy efficiency in cloud data centres.



Relevance to the EC Cloud Computing Strategy

The ability to realise design time simulations and performance prediction will allow the deployment of applications on a wider range of cloud providers and contribute to the goal "Establishing a European Cloud Partnership" by achieving a better interoperability beyond API harmonization activities towards a predictable performance of application across provider boundaries.

Furthermore the impact of the CACTOS optimization toolkit is relying on the use of available standards, in particular the Cloud Management Interface, and will benefit from a consolidation of standards. CACTOS can contribute to "Cutting through the Jungle of Standards" by its definitions of interfaces between optimizers and infrastructures.

The performance prediction and simulation activities will also deliver the knowledge needed for sizing and evaluation criteria definition for infrastructure procurements.

Relevant Standards for Interoperability and Portability

The most relevant standards for CACTOS are the infrastructure and management interfaces within data centres, as the major target is to improve the cloud operator's capability to adapt to changing workloads. Most notably these are the DMTF Standard on Cloud Management Interface (CIMI) and related standards.

Plans for Sustainability and Business Models

The major exploitation path lies in the integration of the developed methods within the commercial cloud middleware of Flexiant (Flexiant Cloud Orchestrator) as well as the proof of concept that the methods can be applied similarly to open source middleware solutions.

The validation is implemented with three distinct scenarios ranging from technical computing enterprise applications with a comparably clear defined application profile up to scenarios with an application mix that are hard to predict in advance.

Links

Website - http://www.cactosfp7.eu

Twitter - twitter.com/cactosfp7

LinkedIn Group - http://bit.ly/CACTOSgrp

References

P-O Östberg et. al, "The CACTOS Vision of Context-Aware Cloud Topology Optimization and Simulation", HotTopiCS'14 (submitted)

CloudCatalyst

Dalibor Baskovc & Andreas Weiss, EuroCloud Europe

Focus Area

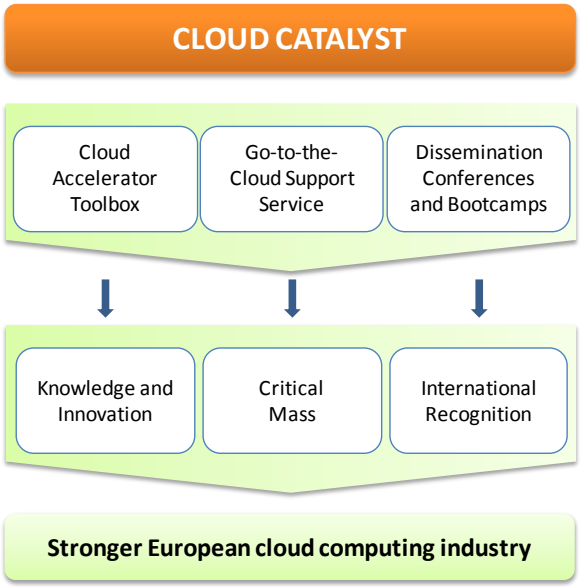


Figure 1 Strategic Concept of CloudCatalyst Ecosystem

CloudCatalyst developed a basic methodology to foster current usage in different EU industries in order to identify the major potential for advanced uses of Cloud solutions. A benchmarking exercise will be performed during the project to identify the main developments, the remaining gaps, strengths, weaknesses and opportunities for cloud computing particularly, in key economic sectors, namely Government, Mass media, Healthcare, Information technology, Banking and Education, within seven countries, Portugal, Spain, Slovenia, Germany, Poland, France, UK. A compilation of reports, studies, analysis, case studies, success stories, legal requirements for Cloud Services adoption was done in the first three months of the project.

Relevance to the EC Cloud Computing Strategy

The EU Commission recognises the importance and potential of cloud computing for the economy, productivity, jobs and growth. The main goal is to enable and facilitate a faster adoption of cloud computing throughout all sectors of the economy. In turn, this would lower and even cut ICT costs; and combined with new digital business practices, it can boost productivity, growth and jobs.

The Commission has developed a long-term vision and is asking countries to work hand in hand in order to ensure that approaches are interoperable across boundaries.

The increase of R&D within the European industry is also an essential component of the Commission's strategy to unleash the potential of cloud and boost the economy.

Methodology within CloudCatalyst project was built to adapt appropriate techno-economic tools for planning, designing and evaluating cloud solutions, namely:

- Common and regional specific requirements for cloud solutions implementation. Categorize the information according to, at least, the following types:
    - Policies (regional / national / European) - data privacy regulation, tax regulation, general compliance requirements, SLAs, Code of Conduct;
    - Available technologies - according to the geographical conditions, by price, by operator, etc.;

- Similar case studies within the parameters;
- Initiatives driven by Government or Commission like EU and country specific funded projects, e.g. Trusted Cloud in Germany, KC Class in Slovenia, G-Cloud in UK, Andromede in France, CloudForEurope.

Relevant Standards for Interoperability and Portability

Some of the challenges already identified in previous EC reports and EC financed projects will be studied further during the project. These include the following topics: large data transmission and inadequate bandwidth; proprietary of services and programming interfaces causing lock-in; problems with trust, security and privacy; varying capabilities in elasticity and scaling; lack of interoperation interfaces between Cloud (resources and services) offerings and between Cloud and other infrastructures.

Overcoming the identified challenges provides Europe with an opportunity to exploit the cloud market. CloudCatalyst aims to develop a step-by-step guide identifying the critical success factors to overcome the current technical challenges for Cloud expansion in order to give additional support and information to the different stakeholders willing to implement cloud solutions.

This guide takes into consideration the work already done by reference European funded projects such as T-Cloud, Vision Cloud, Contrail, OpenNebula, MODAClouds, PaaSage and ARTIST, as well as international projects, such as Nimbus. CloudCatalyst consortium believes that this is essential for defining an outlook for entrepreneurs and business developers.

Plans for Sustainability and Business Models

The consortium plans to develop a set of reference business models that address commercial, technical, legal and social challenges, which are of a relevance to cloud eco-system, and which could be offered to accelerators around EU. It also aims to create an online service where Cloud providers, SMEs and users can collaborate by posting information about Cloud services, existent challenges or opportunities to be addressed.

Links and References

Project website: www.cloudcatalyst.eu

Cloud for Europe

Linda Strick, Peter Deussen

Focus Area

The Cloud for Europe project (www.cloudforeurope.eu) brings together industry and the public sector to provide fair conditions for a digital single market for cloud computing adoption in Europe. Cloud for Europe will give a clear view on the public sector requirements and usage scenarios for cloud computing.

Relevance to the EC Cloud Computing Strategy

The project addresses the objectives of the European Cloud Partnership and contributes to adopting a well-defined European Cloud Computing Strategy for the public sector. Joint pre-commercial procurement (PCP) will be used as an instrument for promoting, among European private sector players, innovative solutions for cloud services that best fit the public sector needs. The project will tender research on cloud services for up to 9 million. The pre-notice will be published in April/May and the tender in July/August. The PCP process comprises three phases: the solution exploration, the prototype and test implementation. Each phase will be evaluated, and awarded bids will get framework contracts.

Relevant Standards for Interoperability and Portability

Data protection and security are the obstacles hindering the public sector's adoption of cloud computing. Strong contracts are needed to ensure that any breaches of data security are avoided and detected. Contract templates, codes of conduct, and model clauses could be provided to procuring partners to manage and build trust in cloud computing. Measurements can be used as a basis to check the security in the cloud.

Interoperability is a basic requirement for shared - between public authorities or cross-border - cloud services. It allows fair competition and is fundamental to integrating components – so that an ongoing innovation process is possible. Interoperability demands common technical and legal parameters – which are related to open standards and governance. Transparency enables trust and encourages active participation in political decision-making processes, supporting cooperation within public administrations and with industry. Furthermore, it fosters continuous innovation. Cloud computing facilitates transparency through shared platforms, standards and principles. From a political perspective it requires common minimum denominators in key regulatory areas to promote cloud in the public sector and in sensitive areas in the private sector. Regulatory decisions at the political level can help to overcome these obstacles. Common minimum denominators in key regulatory areas are required to unleash cloud in the public sector and in sensitive areas in the private sector.

Plans for Sustainability and Business Models

Lessons learnt from the pre-commercial procurement process will be transformed into best practices and recommendations for future pre-commercial procurement activities. This includes establishing suitable contractual terms and conditions for future cloud procurements. Guidance and training materials will be produced for public authorities to support the application of pre-commercial procurement as an instrument to procure cloud services. Industry, and especially SME'S, are invited to participate in discussions about the potential of future public sector cloud solutions. As a result of the pre-commercial procurement process, awarded industry will have prototypical implementations of a pre-product that can be transferred into a product and offered to public administrations. The pre-commercial procurement process sets the conditions.

Links and References

Project website: www.cloudforeurope.eu/

CLOUDINGSMEs

Lorenzo Accardo

Focus Area

The main goal of the CloudingSMEs support action is to act as a catalyst for the accelerated and more successful adoption of cloud computing by European SMEs, while at the same facilitating ICT SMEs in the development, deployment and promotion of their cloud computing solutions. Therefore, the project takes a comprehensive approach to the use of cloud computing by SMEs, which considers both the supply side (i.e. results and endeavours of ICT SMEs with expertise on cloud computing) and the demand side (i.e. the adoption and use of cloud computing technologies by SMEs). The project will build, sustain and grow an SME user community.

Relevance to the EC Cloud Computing Strategy

Adoption of Cloud Computing by SMEs is a key challenge addressed by the EC Cloud Computing Strategy. In this respect the project will:

- Raising awareness about cloud computing within the wider SME communities across different sizes and sectors. SMEs should be provided with objective and understandable information about the cloud, so as to dispel the hype and shape their expectations in a realistic way. To this end, it is also important that information is provided by neutral and SME-friendly sources (such as SME Associations) rather than by account managers of the cloud service providers and vendors. Neutral, objective and SME friendly information can act as a catalyst for SMEs to adopt cloud computing.
- Creating a range of tools (bundled in the form of a toolbox) that could facilitate SMEs in resolving technical (e.g., QoS (Quality-of-Service), security) and non-technical (e.g., legal, ethical, contractual) issues. The toolbox could include model contracts, tools and techniques for ROI (Return-on-Investment) analysis, guides on legal issues, data protection guidelines, case studies, success stories and more.
- Providing a wide range of best practices and blueprints associated with the practical adoption of cloud computing by SMEs. The goal is to facilitate SMEs in taking the right decisions for rapidly adopting and fully leveraging SME.
- Consolidating the SME's voice around cloud related issues, thereby reinforcing the negotiating power of the SMEs.

Relevant Standards for Interoperability and Portability

There are standards for cloud interoperability and portability (such as OGF's OCCI, SNIA's CDMI, Delta Cloud by Apache. We don't intend to contribute to their development, but to include them in the CloudingSMEs standards catalogue.

CloudingSmes will refer to the ETSI Cloud Standards Report (http://ec.europa.eu/information_society/newsroom/cf/dae/document.cfm?doc_id=3988) and will compile with the relevant information as knowledge asset.

Plans for Sustainability and Business Models

The consortium of CloudingSMEs is considering ways to ensure long-term sustainability after the end of the project funding. The key output of the project will be a community of SME users and Cloud providers that will be able to interact with each other. Tools to assess how Cloud providers address the typical SME concerns are under development. Possible ways to ensure sustainability include the creation of a marketplace where demand and offer can meet. An idea that is under consideration is a system of users' evaluation, combined with vendors' self-assessment.

Links

Website - www.cloudingsmes.eu

The projects started 1/07/2013 and have 2 years duration (30/06/2015).

CloudWave – Agile Service Engineering for the Future Internet

Eliot Salant , IBM

Focus Area

Using principles from DevOps, CloudWave aims to utilize deep knowledge of an application's runtime behavior and cloud infrastructure performance to improve efficiency and lower the costs associated with both developing and running Cloud-based services.

CloudWave is built around three central concepts -

1. Create a framework for collecting and organizing monitoring data from both running applications and the Cloud in a way that will make large amounts of heterogeneous data meaningful, such as through filtering, compressing and abstraction techniques.
2. Develop the technology that will allow both applications running on the Cloud and the underlying Cloud infrastructure to modify their behavior to optimize overall performance.
3. Supply application developers with feedback on how their applications actually are performing in the Cloud to allow them to rapidly refine and redeploy their applications.

Relevance to the EC Cloud Computing Strategy

The move to Cloud Computing has been rapidly embraced by the industry, in particular due to the improvement in business agility and lower capital costs associated with the Cloud infrastructure. However, neither the engineering methodology used to produce the services that run in the Cloud nor the cost and time required to create software applications have improved. Additionally, Cloud applications that are a company's lifeblood have exhibited stability problems when faced with unforeseen conditions encountered in Cloud scale proportions.

CloudWave aims to deliver novel tools and software development technologies for developing Software as a Service (SaaS) offerings, while improving the ecosystem for deploying and running these services. Both the Cloud infrastructure and the executing software services will be able to coordinate adaptations to their runtime performance based on optimization recommendations from the CloudWave platform. In parallel, service developers will be given a powerful suite of tools to help redesign their applications based on feedback from actual usage performance.

Relevant Standards for Interoperability and Portability

With support from a community of over 15,000 developers and researchers in over 130 different countries, OpenStack is rapidly becoming the open source, defacto, industrial standard for a massively scalable cloud operating system. CloudWave partners IBM and Intel are active contributors to OpenStack, and will contribute code and API coming from CloudWave to help further this community. Cloud standards, such as W3C, DMTF and OCCI will be both potentially used and contributed to over the course of the project.

Plans for Sustainability and Business Models

CloudWave has a two-pronged approach for creating value from project results, with what we define as both external and internal exploitation.

1. External exploitation refers to direct contributions to the scientific community of the CloudWave framework, which is the collection of all publically released project artefacts, including all design and architecture documents, requirements, use case definitions, API definitions, scientific papers, white papers, and Open Source code.

2. Internal exploitation, CloudWave partners are actively working to make sure that CloudWave research and development will contribute to their organization's strategic plans, and will result in new spinoff technologies, products and business markets, ensuring the sustainability of CloudWave's research results for years to come. Additionally, partners will adopt CloudWave methodologies for their own internal application development, shortening their own internal development cycles, improving application quality and lower development costs.

Links and References

Project website: www.cloudwave-fp7.eu

Project start: November 2013

Project end: October 2016

ClouT - Cloud of Things for empowering the citizen clout in smart cities

Isabel Matranga (Engineering Ingeneria Informatica SpA), Levent Gurgen (CEA).

Focus Area

ClouT is a joint European-Japanese project leveraging Cloud Computing and the Internet of Things (IoT) to make cities smarter, offering a more efficient, sustainable, and increased quality of life and to help them face the emerging challenges such as efficient energy management, economic growth and development. ClouT provides infrastructures, services, tools and applications to city stakeholders such as municipalities, citizens, service developers and application integrators, in order to create, deploy and manage user-centric and innovative city applications. Field trials of ClouT first year results will take place starting from April 2014 in four pilot cities: Santander and Genova in Europe, Mitaka and Fujisawa in Japan.

Relevance to the EC Cloud Computing Strategy

By extending the cloud paradigm to the Internet of Things, ClouT addresses one of the main challenges of the EC Cloud Computing Strategy: enabling and facilitating wider adoption of cloud computing through different sectors of economy. In particular ClouT addresses the public sector and it will promote innovative and more efficient IoT and Cloud based solutions while cutting ICT costs and time spent in developing and deploying city applications. ClouT also encourages international dialogue and cooperation trough its EU and Japanese partner network. The project activities will lead to a fruitful and continuous cooperation between six EU and seven Japanese organisations. This is a great opportunity to exchange best practices and lessons learned. The solutions, techniques and components are the result of a joint development which takes into consideration both EU and Japanese requirements and experiences, promoting a seamless cross border use of ClouT solutions.

Relevant Standards for Interoperability and Portability

ClouT's main challenge is to develop solutions that homogenize the access to a wide pool of city infrastructure information sources. The data available on these infrastructures is exported on cloud storage aimed at providing efficient management of huge amounts of data. To ensure seamless access to very different data sources and provide syntactic interoperability of data, cloud storage standards like CDMI (Cloud Data Management Interface) are used. For this purpose, a CDMI compliant software has been implemented to access and store files as well as access data stored in the cloud. This allows heterogeneous IoT devices to be accessed in a homogeneous way. ClouT closely follows the SNIA (Storage Networking Industry Association) and is inspired by standard reference architectures defined by relevant international organizations like NIST (National Institute for Standards and Technology) and ETSI (European Telecommunications Standards Institute) with the main objective of re-using existing standards and best practices, extending them when needed.

Plans for Sustainability and Business Models

The emergence of IoT and Cloud technologies opens the way to the analysis of new business models for the smart city arena that see a combination of both IoT and Cloud models. The distinction among the City IaaS, PaaS and SaaS suggests a threefold approach where public authorities promote the creation of the City IaaS with public funding while a more balanced public-private partnership would support the City PaaS. As for the City SaaS, applications enabled by the City PaaS services and delivery model, will enable more private initiatives to define and promote actual services. The new models will favour the development and deployment of new innovative services by moving from the usual capital upfront investment model to an operational expense model, thus reducing costs, risks and time to market. The presence in the ClouT Consortium of two European companies, Engineering Ingegneria Informatica SpA and

ST Microelectronics, and on the Japanese side of Panasonic and NTT, ensures that both business realities are analysed.

Links

Website - http://clout-project.eu/

Start date: 1st April 2013

End date: 31 March 2016

References

ENG

Philip Wright and Andrea Manieri. 'Internet of Things in the Cloud: Theory and Practice', The 4th International Conference on Cloud Computing and Services Science (CLOSER), 2014.

NII

Ehsan Ullah Warriach, and Kenji Tei:

Fault Detection in Wireless Sensor Networks: A Machine Learning Approach. the 10th IEEE International Conference on Embedded Software and Systems (ICESS13), 8 pages, 2013.

Tuan Anh Nguyen, Doina Bucur, Marco Aiello, and Kenji Tei. *Applying Time Series Analysis and Neighbourhood Voting in a Decentralised Approach for Fault Detection and Classification in WSNs* the 4th International Symposium on Information and Communication Technology (SoICT2013), 8 pages, 2013.

Tuan Anh Nguyen, Marco Aiello, and Kenji Tei. *A Decentralized Scheme for Fault Detection and Classification in WSNs*. The 1st International Conference on Cyber-Physical Systems, Networks, and Applications, WIP session, 4 pages, 2013.

Dong-Hoon Shin, Kyong-Ho Lee, Fuyuki Ishikawa. *A Graph-based Approach Enhancing Correctness and Speed of Web Services Composition through Explicit Specification of Functional Semantics*, International Journal of Web and Grid Services (IJWGS) # submission/acceptance is in 2013, publication is later

Julian Padget, Ken Satoh, Fuyuki Ishikawa. *A Normative Approach to Exploring Multi-Agency Privacy and Transparency*. The 7th International Workshop on Juris-informatics (JURISIN 2013), October 2013

NTT R&D

Conference: IEEE WF-IoT

Takayuki Suyama, Yasue Kishino and Futoshi Naya. *Abstracting IoT Devices using Virtual Machine for Wireless Sensor Node*s. IEEE World Forum on Internet of Things, 2014.

Hiroyuki Maeomichi and Akihiro Tsutsui. *Interoperability Enhancement for Virtualization of Sensors for Smart Cities*. IEEE World Forum on Internet of Things, 2014.

CEA

Yazid Benazzouz; Christophe Munilla; Ozan Gunalp; Mathieu Gallissot; Levent Gurgen. *Sharing User IoT devices in the Cloud*. IEEE World Forum on Internet of Things, 2014.

CoherentPaaS - A Coherent and Rich PaaS with a Common Programming Model

Ricardo Jimenez-Peris, Marta Patiño-Martinez

Focus Area

Currently enterprises use a combination of cloud data stores (such as key-value data stores, graph databases, document-oriented databases), SQL databases and other cloud data management technologies. However, this combination is ad-hoc and it loses data consistency in the advent of failures and concurrent access due to the lack of transactional support across data stores. Additionally, querying a set of such cloud data stores implies individual queries over each data store. This makes it complex to program queries across data stores, for instance, a join across two data stores, since the application programmer has to know how to implement a query. CoherentPaaS addresses this problem and integrates an ultra-scalable transactional processing with 7 different cloud data management technologies enabling transactions across any of the 7 data stores. It also provides a common query language that enables exploitation of the richness of the individual query languages while also enabling queries across data stores such as a join across two different data stores.

Relevance to the EC Cloud Computing Strategy

The project addresses the simplification of cloud application development to foster cloud adoption.

Relevant Standards for Interoperability and Portability

The project addresses two sets of technologies, established, like SQL and new, like NoSQL data stores, that have no standards yet. Therefore, there is no standard contribution that can help in the project results adoption.

Plans for Sustainability and Business Models

The path for the exploitation is through a combination of two approaches:

1. UPM and another partner will create a startup to commercialize the ultra-scalable transactional processing and SQL support
2. Each of the other SMEs participating in the project that are makers of a data store technology will be able to do joint commercialization of the transactional processing and the different data management technologies.

Links

Website - http://coherent.eu

ENVISAGE - Engineering Virtualized Services for the Cloud

Rudolf Schlatte, Einar Broch Johnsen

Focus Area

Virtualization is a key technology enabler for cloud computing and for fine-grained resource management. ENVISAGE targets the challenges inherent in virtualization and delivering services in the cloud, including leveraging contracts and service-level agreements into programming models and leveraging resource management into the service design phase.

To meet these challenges, ENVISAGE develops a formal development framework for Software-as-a-Service (SaaS) in a virtualized environment, which can be integrated into existing development processes, including

- A design-by-contract methodology including service-level agreements,
- Defining application-level services with resource requirements,
- Modeling deployment scenarios reflecting elastic, virtualized architectures,
- A monitoring system assuring adaptability to failures and to renegotiations of service-level agreements, and
- The systematic analysis of quality of service behaviors at early development stages.

Relevance to the EC Cloud Computing Strategy

The key actions of the EC Cloud Computing Strategy are: development of safe and fair contract terms and conditions; cutting through the jungle of standards; and establishing a European cloud partnership.

The main focus of ENVISAGE lies in formalizing service-level agreement contracts. Such contracts will make costs and resource requirements predictable during early development. After deployment and during operation, contract-derived monitoring solutions will result in better accountability and openness both for cloud providers and their customers. Enhanced predictability of the resource needs of cloud deployments will lead to better utilization of cloud resources and thus to lower cost and higher efficiency in the European cloud market.

Relevant Standards for Interoperability and Portability

The main impact of ENVISAGE on standardization will be related to the virtualization of resources, the deployment and scaling of services on the cloud, and service-level agreements. ENVISAGE outcomes will provide original and interesting features to influence the evolution of current standards like the Open Virtualization Format and the Open Cloud Computing Interface.

ENVISAGE will leverage the control over low-level resource management to create an abstract programming model. Concerning platform-independent modeling of distributed systems, ENVISAGE will enhance interoperability by linguistic integration of virtualization and service-level agreements. This significantly reduces complexity in SaaS development and will be aligned with the emerging standards. Concerning SLA formalization and management, ENVISAGE outcomes will help advance the main standards related to this topic, such as WS-Agreement, WSLA, and WSOL.

Plans for Sustainability and Business Models

The ENVISAGE toolset and its industrial case studies will be presented at application-oriented workshops and conferences, and at industry fairs. The project will deliver open-source software components to permit independent development initiatives and broaden the use of ENVISAGE toolset, both by open-source enthusiasts and industry. A dedicated section of the project web site will make ENVISAGE open-source available under an OSI-approved license such as the Common Public License (CPL).

Another pillar in our exploitation strategy is the establishment of the ENVISAGE collaboratory, whose main goal is to guarantee the long-term exploitation of ENVISAGE outcomes by building user communities for our methodology and tools. Regarding industrial exploitation, the top three areas initially targeted for project exploitation are search technology, e-commerce services, and cloud provisioning, which are covered by our industrial participants. For maximum uptake of project results we will use the ENVISAGE collaboratory to maintain interaction with prospective users and beneficiaries of the project during and after the lifetime of ENVISAGE.

Links

Website - http://envisage-project.eu

References

Envisage (Engineering Virtual Services, FP7 610582) Oct. 2013-Sept. 2016,

Envisage Fact Sheet - http://envisage-project.eu/wp-content/uploads/2013/10/Envisage_factsheet.pdf

Envisage Position Paper: E. Albert, F. de Boer, R. Hähnle, E. Broch Johnsen, C. Laneve: Engineering Virtualized Services. Proc. NordiCloud 2013, pg. 59-63. ACM. DOI: 10.1145/2513534.2513545. http://dl.acm.org/citation.cfm?doid=2513534.2513545

HEADS - Heterogeneous and Distributed Services for the Future Computing Continuum

Franck Fleurey, SINTEF, Norway (franck.fleurey@sintef.no)

Focus Area

The idea of the HEADS project is to leverage model-driven software engineering and generative programming techniques to provide a new integrated software engineering approach which allows the advanced exploitation of the full range of diversity and specificity of the future computing continuum. The goal is to empower the software and services industry to better take advantage of the opportunities of the future computing continuum and to effectively provide new innovative services that are seamlessly integrated to the physical world making them more pervasive, more robust, more reactive and closer (physically, socially, emotionally, etc.) to their users. We denote such services **HD-services**.

Relevance to the EC Cloud Computing Strategy

The general exploitation strategy of HEADS is closely connected with and inspired by the recommendations provided by ISTAG – Information Society Technologies Advisory Group6, in its report on Software as a Key Enabling Technology (KET). These recommendations will also be the basis for HEADS' planned collaborations with on-going projects (identified in Section 1.2) to contribute to these recommendations. In particular:

Recommendation 6.1: "*Support the effort that by 2020, **software intensive real time systems should be executable on shared hardware and easily connectable to the outside world.***"

Recommendation 7: "*Embedded systems will increase the intelligence, control and communication capabilities of a wide range of objects, enabling their interaction and cooperation with people and organizations. **Such smart objects will be joined together to create highly distributed systems to address for instance societal challenges**. As a consequence, **Europe should develop new scientific foundations, system design methodologies, development processes and tools to create the technical solutions tackling the challenges posed by system complexity** (e.g. system behavior, dynamic growth, availability, fault tolerance, safety and security).*"

Recommendation 8.1: "*Research has to be undertaken **towards the integration of cloud services, device ensembles, and community-based interaction**, leading to the paradigm of "user-centred interaction in the cloud"*

Recommendation 9: "***The Internet of things has become reality generating a volume of data never envisioned in mankind history. Enterprise software needs to cope with this massive data** to provide business process management taking real time real world information into account.*"

These ISTAG recommendations are closely related to the objectives of HEADS to provide **methods and tools** for designing and deploying **adaptable services** whose logic can be distributed across the **future computing continuum spanning from cloud computing to small devices.** Furthermore HEADS address Complex-Event Processing engines and queries across an infrastructure spanning from cloud to IoT devices providing **a scalable solution to the aggregation and query of massive data flows.**

Relevant Standards for Interoperability and Portability

The HEADS project bases most of its technical development on open standards, such as the well-established Eclipse Modeling Framework (EMF) for the definition and implementation the HEADS modeling

6 "Software Technologies. The Missing Key Enabling Technology. Toward a Strategic Agenda for Software Technologies in Europe", July 2012. http://cordis.europa.eu/fp7/ict/docs/istag-soft-tech-wgreport2012.pdf

languages. HEADS also seek to use technologies currently being standardized, such as the emerging OASIS standard MQTT (SoftwareAG is actively participating) or CoAP (at IETF) for the communication between resource-constrained devices. HEADS can provide relevant feedback and influence the on-going standardization process. HEADS also works in synergy with on-going FP7 projects (typically IPs with dedicated efforts for standardization) in order to rationalize and strengthen standardization efforts. In particular, HEADS may contribute to the standardization of the CloudML language (mainly driven by FP7 MODAClouds and PaaSage IP projects) by extending the concept of CloudML to the computing continuum, from cloud (main focus of MODAClouds and PaaSage) to mobile and resource-constrained platforms. The collaboration to this joint standardization effort is driven by SINTEF, which is involved in both MODAClouds and PaaSage.

Plans for Sustainability and Business Models

The main result of the HEADS project is the HEADS IDE for HD-Services development. The HEADS IDE and modelling languages are fully released as open-source using non contaminating licenses (such as LGPL or EPL) to allow both proprietary usage and extensions. The HEADS IDE is complemented by methodology document which (1) guides developers of HD-Services in using the HEADS techniques and tools and (2) guides platform experts to add support for new platforms by developing plugins for the HEADS IDE. The objective of the project is not to provide a complete set of plugins covering the whole future internet continuum but a set of selected representative plugins which (1) demonstrate the approach, (2) makes it available to third parties and (3) cover the needs of the use cases. A HEADS plugin for a particular platform includes a code generator for the specific platform, a HEADS model library (API) exposing the capabilities of the platform and a mechanism for deploying code to the platform. The plugins supporting different platforms can be released with different licences. All the generic code generators to general purpose language will be released as open-source. All the plugins developed by the academic partners will be released open-source. Plugins and specialization made by the industry partners and for the use cases might be kept proprietary. Third parties will be provided with the tools and documentation necessary to develop third party plugins.

Links and References

Project Start- October 1st 2013
Project End - September 30th 2016
Website - http://heads-project.eu/

MONDO – Scalable Modelling and Model Management on the Cloud

Scott Hansen, The Open Group, Dimitris Kolovos, University of York

Focus Area

As Model Driven Engineering (MDE) is increasingly applied to larger and more complex systems, the current generation of modelling and model management technologies are being pushed to their limits in terms of capacity and efficiency, and as such, additional research is needed to enable MDE to remain relevant within industrial practice and to continue delivering its well-recognised benefits of increased productivity, quality, and maintainability.

The aim of MONDO is to tackle the increasingly important challenge of scalability in MDE in a comprehensive manner. Achieving scalability in modelling and MDE involves being able to construct large models and domain specific languages in a systematic manner, enabling teams of modellers to construct and refine large models in a collaborative manner, as well as advancing the state-of-the-art in model querying and transformations tools so that they can cope with large models (of the scale of millions of model elements), while providing an infrastructure for efficient storage, indexing and retrieval of large models.

Relevance to the EC Cloud Computing Strategy

As application model size increases and larger teams of software developers attempt to collaborate in increasingly complex modelling of new applications, the use of Cloud based services for model management will substantially increase. MONDO is developing the new Cloud based infrastructures that are already needed to address today's application modelling and collaboration complexity, which will also be scalable to support the needs of future generations of applications. The technologies being developed will stimulate the take-up and effective use of Cloud computing within the communities of European software developers. MONDO technologies will preserve existing MDE and Cloud based application projects, while providing the ability to substantially extend the features and capabilities of applications in a more manageable and efficient manner, and with increased collaboration within software development teams. The expected improvements in efficiency and productivity will encourage greater take-up of Cloud-baseed model-driven engineering within European industries.

Relevant Standards for Interoperability and Portability

The project utilises well-established standards for model driven software engineering including UML for modelling of applications, XMI for exchanging model information and a range of other standards for storing and querying applications models, many of which are specified by the Object Management Group (OMG) standards organisation. For some existing MDE standards the project anticipates extending or proposing new standards that are significantly more efficient for modelling large and complex applications, or that provide higher performance for storing and querying applications models, which will encourage greater re-use of application models within software development organisations. An example would be the XMI standard that is well established but is inefficient when used for managing large application models. It's likely that OMG would be one of the standards making bodies that would be targeted for building consensus for newly developed specifications from MONDO. Other standards making bodies involved in storing and querying of data may also be targeted.

Plans for Sustainability and Business Models

The MONDO project was launched in November 2013 and to date has focused on specifying industrial requirements in collaboration with the four industrial users in the project, as well as detailed technical requirements for achieving the planned innovations. A key decision taken by the project at this early stage is to use an open source business model whereby all of the technologies developed will be made openly

available to encourage the broadest take-up by European organisations involved in MDE based software development. The open source approach is also expected to be attractive to Cloud-based service providers who will be able to exploit, for commercial interests, the increased efficiency and performance provided for their client organisations that utilise Cloud-based services for software development. A key element for sustainability will be the creation of a community of users and contributors to the open source technologies and the project includes dissemination actions to create awareness and to collaborate with existing communities of MDE developers (e.g. Eclipse.org) to build a community of interested users and contributors to ensure long-term sustainability.

Links and References

Project website: www.mondo-project.org

Project start: 1 November 2013

Project end: 30 April 2016

ORBIT - Enhancing availability and fault-tolerance of clouds with cost-effective, application agnostic approaches

Dimosthenis Kyriazis, Andreas Menychtas, Theodora Varvarigou

Focus Area

As more and more areas of public life are dependent on availability of Internet-based services, service outages highlight serious implications on the continued operation of businesses - causing direct loss of revenue, legal liabilities as well as long-term damage to reputation and brand name, and the services delivered to the end users. Current approaches for mitigating the effects of downtime requires significant investment with meticulous planning to appropriately address each type of common downtime cause, application-specific improvements or expensive hardware-level approaches. ORBIT will introduce a new paradigm of virtualized resource consolidation in which memory and I/O resources used by a guest VM are provided by multiple external hosts, while combining the features of this novel paradigm with approaches ranging from single-host fault-tolerance to entire-site metropolitan area network based disaster recovery. The latter will allow for application-agnostic high availability, opening up cloud computing to mission-critical applications that require 24/7 availability.

Relevance to the EC Cloud Computing Strategy

ORBIT is expected to significantly contribute towards strengthening the software and cloud industry in Europe by providing approaches to enrich existing cloud offerings, such that they may support the end-to-end demands of business continuity. Through open source contributions, ORBIT innovations will be easily exploitable by any existing or new players in the cloud infrastructure or cloud provision markets. What is more, ORBIT will enable fault-tolerance and disaster recovery across cloud environments, thus addressing the needs of data intensive distributed applications. Aiming to increase quality of experience and service provisioning, ORBIT will offer guaranteed services to individual consumers, through approaches that minimize periodic service disruptions ranging from personal use, such as media and entertainment, to public use, such as local and government services. It is of major importance to highlight that ORBIT outcomes target cost-efficiency, thus allowing any stakeholder (including SMEs) to provide highly available services without the requirement of large up-front investments in software or specialized hardware.

Relevant Standards for Interoperability and Portability

ORBIT outcomes will be delivered as open source artefacts aiming both to wide exploitation and to influencing current open standards. Achieving the acceptance of Linux as a mission-critical platform is a step towards this direction, while open standards for virtualization software, data protection and Linux-based systems utilization and management will be exploited. Given the emphasis on virtual resources, ORBIT will follow and contribute to Open Virtualization Format (OVF) with respect to CIM profiles, Distributed Management Task Force (DMTF) regarding Virtualization Management (VMAN), and Open Grid Forum (OGF) regarding potential Open Cloud Computing Interface (OCCI) extensions, developed through the integration of ORBIT outcomes in cloud-related software such as OpenStack.

Plans for Sustainability and Business Models

Open source software licensing is the identified effective route for sustainability and exploitation of the ORBIT results. The outcomes will be licensable in an open list of approved open source licenses (approved by the Open Source Initiative) and available through different forges (e.g. SourceForge.net, GitHub). Aiming to exploit ORBIT outcomes, existing open source communities have already been identified and the corresponding target outcomes, such as KVM Virtio through Kernel Based Virtual Machine, fault-tolerant QEMU through Qemu Open Source Processor Emulator, scheduler and interfaces to OpenStack. Versions

will be continuously forwarded to the upstream community with respect to Libvirt, QEMU, and OpenStack so as to raise awareness on project results and further detail the envisioned exploitable routes.

Links and References

Project Website http://www.orbitproject.eu

Twitter @ORBIT_PROJECT_

LinkedIn http://www.linkedin.com/groups/ORBIT-EU-FP7-Project

The project started on 1 October 2013 and its duration shall be 30 months, ending on 31 March 2016.

PANACEA - Proactive Autonomic Management of Cloud Resources

Dr. D. R. Avresky Research & Development Coordinator

Focus Area

The main objective of the project "PANACEA" is to provide Proactive Autonomic Management of Cloud Resources as a remedy to the exponentially growing complexity. The aim of a Cloud Computing platform is to support redundant, self-recovering, highly scalable programming models that allow workloads to recover from many inevitable hardware/software failures. PANACEA will propose innovative solutions for autonomic management of cloud resources, which will be based on a set of advanced Machine Learning Techniques and Virtualization. It will allow predictions of the failure time of software, or user applications, running on Virtual Machines (VM) and the violation of expected response time of services.

Relevance to the EC Cloud Computing Strategy

A Cloud Computing platform is more than a collection of computer resources, because it provides a mechanism to manage those resources. In a Cloud Computing platform, software is migrating from the desktop into the "clouds" of the Internet, promising users anytime, anywhere access to their programs and data. The Cloud Computing paradigm poses an enormous set of challenges to the current and future Internet. The design that you have must deal with the fact that components are going to fail. The question is how to shield that from the end user to keep applications running. Being able to quickly move workload from one source to another is a critical vehicle to achieve that objective. PANACEA's Machine Learning Framework's predictions will support a proactive autonomic management of cloud resources and increase the cloud services availability.

Relevant Standards for Interoperability and Portability

PANACEA will use standard APIs, interfaces and formats, like OCCI to interface with OpenNebula or OVF to define VMs. OpenNebula in turn provides adapters and translators to other APIs, interfaces and formats, whether standard or not. PANACEA will also provide feedback to international standardization bodies about its feasibility and usability. Some PANACEA partners have launched several domain-specific open source communities, which will be used as dissemination vehicles for achieving high impact of PANACEA results. Other service-related initiatives will be considered for collaboration on a case-by-case basis. These initiatives look at opening up cloud computing and reducing barriers to interoperability, examples are the open data centre alliance and open cloud consortium, as well as standards organisations. The shared goals of PANACEA and these initiatives make them potential partners for dissemination and research collaboration.

Plans for Sustainability and Business Models

Following from the work in tasks the identified models will be analysed further considering ownership and governance models, constraints on the partners and the technical limitations. According to this analysis and the individual exploitation plans of the consortium, the choice of models will be reduced until one model is commonly accepted. A detailed business plan for implementation of the chosen model will be drafted, including roles and responsibilities, revenues and cost structure. Implementation steps will be established and the partners will negotiate an exploitation agreement covering this and their individual plans. Compatible with the common model for sustainability agreed by the project, the participants will each identify, explore and seize opportunities for individual exploitation, using all or a subset of the project results. This includes commercial and teaching and research opportunities. The task leader will act as a consultant to each partner, who will devise steps for implementation and report progress to the consortium.

Links and References

Panacea website: www.panacea-cloud.eu

Project starts: October 1st 2013

Project ends: March 31st 2016

S-CASE – Scaffolding Scalable Software Services

Andreas L. Symeonidis, Dionysis D. Kehagias, and Isabel Matranga

Focus Area

S-CASE aims to provide a cloud-based realm of services and tools for software developers to enable rapid software prototyping based on user requirements and system models, provided in multimodal formats. It will allow the extraction of system specifications and low-level architecture, as well as the discovery and synthesis of composite workflows of software artefacts from distributed open source and proprietary resources. S-CASE will provide an engine for transforming functional components into web services that can be combined, indexed and published on the S-CASE cloud infrastructure. In this way, an ecosystem of services will be developed, providing a pool for reusable software artefacts and eliminating the cost barrier of developing quality software for SMEs.

Relevance to the EC Cloud Computing Strategy

The EU Cloud Expert group report[7] identifies three reasons with significant impact to Europe's decision to push the cloud potential:

1. Cloud infrastructure provides a means to utilise more cost-effective IT thus gaining commercial benefits
2. it provides a means to access more advanced ICT than through usual architectures allowing more 'adventurous' use of computing, and
3. it provides an opportunity for IT providing industry to offer their services in an open marketplace and gain consequent commercial benefits.

S-CASE will provide the appropriate infrastructure (tools, mechanisms and underpinning technologies) in order to facilitate efficient software engineering for cloud-based applications. Through the innovations it introduces, S-CASE is expected to accelerate the development and deployment of cloud computing, increase Europe's ability to design and deliver innovative services with strong user engagement through better involvement of SMEs and individual researchers/developers, and strengthen the European software industry with the know-how to build complex services and big data management in a multi-layered cloud computing continuum.

Relevant Standards for Interoperability and Portability

Standardization is one of three key objectives defined within the EU cloud strategy for 2013 and 2014. S-CASE is an open source platform that will try to contribute to this area in four ways:

1. **Semantic Matchmaking and Web Services**, S-CASE aims to contribute to a set of standards regarding service interoperability and orchestration (by extending BPEL to RESTful services) and service annotation (building new ontologies).
2. **Software Engineering**, the project will explore and foster already existing (open-source and commercial) standards in order to allow users transit to the *S-CASE* software development paradigm. The PIM to PSM transformation models and the UML profile for RESTful web services will follow the OMG standards and will be public.

[7] cordis.europa.eu/fp7/ict/ssai/docs/future-cc-2may-finalreport-experts.pdf

3. **Multimodal Information Processing**, S-CASE will build a mechanism that couples information from textual descriptions, storyboards and UML diagrams, static descriptions and dynamic behaviors in order to define an automated software building process.
4. **Cloud computing**, S-CASE will provide the YouRest cloud platform and services along with the tools for developers to import or export services from the platform.

Plans for Sustainability and Business Models

The S-CASE paradigm will introduce new business models for service providers and software SMEs who are willing to provide integrated end-customer solutions, minimizing development costs and effort. With respect to the commercial exploitation of the S-CASE platform, software developers (including SMEs, software houses, independent developers) are provided with tools to enable rapid software prototyping, minimizing the costs and efforts involved in the various processes of the software development lifecycle. Solution providers (including web service providers, SaaS providers, SMEs, software houses and independent developers) are provided with the tools for registering their solutions in a marketplace-like repository enabling the visibility of their assets in an open wide audience of application developers. The definition of specific business rules offer the opportunity to the solution providers to determine the business model that best fits their needs and guarantee the profit maximization. Additionally, the use of the S-CASE platform as is, is expected to provide benefits. S-CASE aims at establishing a whole new paradigm for accelerating the overall agile software prototyping process along with the corresponding support community. Through its release in the Eclipse marketplace (http://marketplace.eclipse.org), the S-CASE developer tools will be available to the developers' community. This will increase also commercial uptake of the S-CASE generated solutions.

Links and References

Project website: www.scasefp7.eu

Twitter: http://twitter.com/scasefp7

Facebook: Bit.ly/SCasefb

LinkedIn: bit.ly/SCasegrp

Project start: 1 November 2013

Project end: 31 October 2016

SeaClouds - Open source multi-cloud application manager for PaaS

Francesco D´andria, Atos Spain

Focus Area

SeaClouds project aims to solve the problem caused by the current lack of standardization in cloud services, which pushes cloud customers to end up "locked-in" with the chosen cloud provider(s). In the current situation, it is possible to deploy and monitor a stand-alone application, but not a complex one. Even if frameworks for complex applications on the Cloud can be used, this requires changing the code or using modelling languages. The project works towards giving organizations the capability of "Agility After Deployment" for cloud-based applications, by supporting developers and application managers through the creation of an open source platform that leverages open standards (such as OASIS CAMP and TOSCA) in order to support the deployment of applications over multiple-clouds, the monitoring of such deployments, and the migration of application modules across different (both public and private) cloud providers if needed.

Relevance to the EC Cloud Computing Strategy

SeaClouds directly impacts on the way developers are going to build cloud apps without worrying about underlying execution of different PaaS or IaaS providers, relying on its service orchestration capabilities based on informed election among of the provider. In this regard, SeaClouds allows developers and development companies to take a much shorter and consolidated approach over different underlying technologies and stacks (proprietary and open source). At the same time, it offers application monitoring and adaptation based on different factors, cloud infrastructure and application behaviour helping developers with these difficult tasks. In this scenario, the SeaClouds project can be seen as an enabler fostering a much better and ready ecosystem for developers, especially those who do not have experience on cloud, or are experienced in a particular cloud technology.

By allowing developers to monitor and audit underlying PaaS and IaaS execution of their cloud applications, SeaClouds will contribute to the market by creating the means for developers to simplify application monitoring and independently of the underlying vendor. This could help applications developers or service providers to create self-adaptive applications that comply with stricter requirements and SLAs from their customers. They will also be able to offer their clients and users SLA definition and compliance, which would clearly affect how providers and clients will establish commercial relationships. This capability will allow the possibility of having clearer and transparent contract relations between cloud providers and application customers.

Relevant Standards for Interoperability and Portability

SeaClouds aims to establish a mutually beneficial relationship with the standards bodies. Since it will be developed according to emerging standards, SeaClouds will get constant feedback from their users and, at the same time, will contribute to their dissemination and evolution. The main standards that SeaClouds will rely on are:

- Cloud Application Management for Platforms: CAMP aims at defining a harmonized API as well as models, mechanisms and protocols for the self-service management (provisioning, monitoring and control) of applications in a PaaS, independently of the cloud provider. SeaClouds intends to actively contribute to the standardization effort of CAMP by implementing a CAMP-compliant interface towards PaaS providers for management, and by contributing review proposals that will possibly emerge while specifying properties of SeaClouds orchestrations, adaptation and monitoring.

- ***Topology and Orchestration Specification for Cloud Applications:*** TOSCA aims at enhancing the portability of cloud applications and services. The main aim of TOSCA is to enable the interoperable description of application and infrastructure cloud services, the relationships between parts of the service, and the operational behavior of these services, independently from the cloud provider. By increasing service and application portability in a vendor-neutral ecosystem, TOSCA aims at enabling portable deployment to any compliant cloud, smoother migration of existing applications to the cloud, as well as dynamic, multi-cloud provider applications. SeaClouds will exploit the TOSCA specification to drive the design of the model for specifying cloud service orchestrations in SeaClouds. In doing so, SeaClouds will contribute to the standardization effort of TOSCA, by contributing review proposals that will emerge while trying to devise TOSCA-compliant instances of the SeaClouds service orchestration model. SeaClouds will also look at the developing functionalities that are out of scope of TOSCA to solve the issues about policies surronding the dynamic management of service orchestrations.

Plans for Sustainability and Business Models

Two exploitation approaches have been considered to ensure the sustainability of the SeaClouds solution:

Open Source. The SeaClouds consortium has agreed to release the SeaClouds framework under an Open Source approach. This will allow its use by the developer community, and promote it in an effort to create a reference framework that will contribute to the development of cloud applications, eliminating vendor lock-in at and performing application monitoring at the PaaS and IaaS level.

A Commercial Entity providing services. The consortium will evaluate the option to create a new business entity by partners of the consortium interested in evolving SeaClouds. This will test different business models with the intention of creating a sustainable business by selling services or technology.

Links and References

Project website: http://www.seaclouds-project.eu/

Twitter: https://twitter.com/SeaClouds_EU

Facebook: https://www.facebook.com/seacloudsproject

LinkedIn: http://www.linkedin.com/groups/SEACLOUDS-PROJECT-7449431

Project start: October 2013

Project end: February 2016

SyncFree - Large-scale computation without synchronisation

Tyler Crain, Marc Shapiro, INRIA & LIP6

Focus Area

SyncFree focuses on large-scale on-line services built on top of cloud computing systems, including social networks and multiplayer games, that handle huge quantities of frequently changing, shared data. A key requirement of these applications is to ensure data consistency, protection of confidential user information (e.g. protection of bank details) and appropriate permissions (e.g. only authorised sharing of information or content). With the quickly growing user base of these applications, increased scalability requirements are posing challenges to maintaining data consistency especially in modern cloud systems that are becoming more and more distributed compared to traditional centralised clouds. A key challenge lies in replicating data across several distributed datacentres, requiring new principled approaches to consistency.

SyncFree, is funded under the European Commission's 7th Framework Programme, Software & Services, Cloud Computing, DG CNECT [1], and will address these challenges by driving new principled approaches to consistency.

Relevance to the EC Cloud Computing Strategy

Maintaining strong consistency at the scale needed for modern clouds is becoming a major technological barrier. For many online services because of issues like network delays, operational costs, and hardware failures are preventing many organisations from harnessing the full power of the cloud. Many essential applications also require robust sharing that maintains the consistency of shared and mutable data. Examples include massive multi-player online games, online mobile games, advertising platforms, collaborative social networks, and information networks (e.g. healthcare). Without standards or principled approaches, much of the power of the cloud will be left inaccessible for many applications.

The EC Cloud Computing Strategy aims to maximise the potential offered by the cloud by speeding up the use of cloud computing across all economic sectors. The SyncFree project will help enable this growth by providing new and intuitive ways to build scalable cloud-based applications with solutions including standard data types and principled approaches to consistency.

Relevant Standards for Interoperability and Portability

Current solutions for ensuring data consistency in modern clouds made up of loosely coupled, widely distributed localised datacentres of all sizes systems require highly specialised, expert technology and investment, with application development usually led by only a few large organisations.

SyncFree will address these challenges by using a principled approach to enabling robust sharing, called Conflict-Free Replicated Data Types (CRDTs). CRDTs avoid the complexities of ad-hoc approaches, while maintaining the scalability advantage.. By following a few simple mathematical principles distributed updates can occur without synchronisation, while still ensuring a level of data consistency that enables the development of powerful applications. What's more, CRDTs eases development by encapsulating the replication and concurrency properties of common shared objects, such as sets, maps, sequences, or graphs. The project will develop and propose standards for these data types including libraries of open-source data structures to be used by organizations looking to benefit from the cloud, thus providing scalable solutions to quickly develop cloud-based applications.

Plans for Sustainability and Business Models

The SyncFree project will advance both the theory and practice of large-scale application architectures, especially of CRDTs and related mechanisms. With several SyncFree partners coming from European-based enterprises who already have large user bases and feel the need for increased scalability in their applications, the project will include an extreme-scale crowd-sourced experiment, pushing the scalability needs of real world applications. Furthermore, an open-source library of CRDTs, to be used in future scalable distributed applications, will be made available, leaving a lasting and beneficial impact far beyond the end of the project.

Using these open source libraries, organisations will be able to create highly scalable programs more easily, meeting the strict consistency requirements present in today's highly connected services while improving user experience through low latency and fault tolerance. These advantages will help extend the reach of the cloud into mainstream connected applications and services and provide the platform for the creation of new and innovate cloud-based businesses.

Links and References

[1] https://syncfree.lip6.fr/.

Funding

SyncFree is funded under the European Commission's 7th European Framework, Software & Services, Cloud, DG CNECT (FP7 ICT Call 10). This 3-year project started in October 2013.

CIP-funded initiatives

ECIM – European Cloud Marketplace for Intelligent Mobility

Gorazd Marinic, iMinds

Focus Area

ECIM aims to help three key audiences - service creators, city managers and service users – to benefit from the ability of cloud computing to make transportation and other city services more innovative, cost effective and accessible.

ECIM will:

1. Allow cities and businesses to easily migrate existing services to the cloud
2. Open cloud-based services to innovators for use as the basis for new applications and services
3. Publish these services in a catalogue (Marketplace), which will enable cities across Europe to easily access, combine and adopt them

Relevance to the EC Cloud Computing Strategy

Migrate, test, validate and aggregate private and public sector services to the cloud. Open interfaces (APIs) will lead to interoperability and portability (regionally and across national borders).

Privacy and data protection will be addressed by eID STORK implementation. Additionally, ECIM will foster common specifications for cloud-based mobility services, and provide a platform where citizens, SMEs and Public Sector can create innovative new services.

Relevant Standards for Interoperability and Portability

ECIM will make use of most common Web Service formats, SOAP and REST (JSON) to communicate on one side with service and data providers and on the other side with end users with different devices, from PCs to Smartphones.

Plans for Sustainability and Business Models

The data captured city pilots will contribute to sustainability by leveraging the lessons learned during the pilot to create a guide/checklist to provide improvements for the platform and roadmap for future ECIM deployments.

References

Project start: January 2014

Duration: 30 months

STORM CLOUDS - Guiding public authorities to the cloud

Agustin González-Quel, Ariadna S.I.

Focus Area

STORM CLOUDS aims to explore how the shift by public authorities to a cloud-based paradigm in service provisioning should be addressed.

STORM CLOUDS will define useful guidelines on how to address the process in order to accelerate it, for public authorities and policy makers. These guidelines will be prepared based on direct experimentation in at least four European cities, creating a set of relevant use cases and best practices. By doing so, STORM CLOUDS will also deliver a consolidated cloud-based services portfolio validated by citizens and public authorities in different cities and, at the same time, general and interoperable enough to be deployed in other European cities not taking part in our project, as well as scaled up to wider geographical scopes. This portfolio will be mainly created from applications and technologies delivered by other CIP-PSP and FP7 projects, as well as resulting from innovation efforts from SMEs.

Relevance to the EC Cloud Computing Strategy

In September 2012, the European Commission adopted the European Cloud Computing Strategy for "Unleashing the Potential of Cloud Computing in Europe". This strategy highlights the critical role of European public authorities. The public sector has a key role to play in shaping the cloud computing market. But with the public sector market fragmented, its requirements have little impact, services integration is low and citizens do not get the best value for money.

Within this context, STORM CLOUDS supports the efforts accelerating up-take of cloud computing by European public authorities, and facilitating the up-take at European level of cloud-based services resulting from R&D and innovation. Interoperability, reusability and scalability of services will be key aspects for these purposes.

Relevant Standards for Interoperability and Portability

STORM CLOUDS is based on the following pillars:

- Open Innovation procedures applied to the City ecosystem
- Open Source IaaS, starting from Eucalyptus and OpenNebula and, more recently, OpenStack and CloudStack. A procedure for technological watch will be followed.
- Automated deployment tools are widely used in data centres for installing operating systems and commonly used applications on bare metal or virtual machines. Puppet and Chef provide advanced functions of this sort but do not provide out-of-the-box features for fundamental aspects of cloud applications like the virtual objects needed for running an application.

Plans for Sustainability and Business Models

The STORM CLOUDS sustainability plan is based on an eco-system approach that looks at reciprocal benefits to different types of stakeholders within that eco-system. In this scenario, the market environment for STORM CLOUDS is made up of networks of municipal governments that deliver services to citizens and businesses that then interact through those services.

In its analysis of business sustainability, STORM CLOUDS will take care of the value that public administrations are to deliver to their "customers" (Citizens, SMEs, large industries, ...). To give continuity to the testbed results within EU public administration, a broader framework has to be defined and implemented that integrates social, institutional and economic dimensions, addressing issues such as legitimacy, social value, and efficiency.

Virgo – Virtual Registry Of The Ground Infrastructure

Salvatore Lombardo

Focus Area

The main outputs and results of VIRGO are:

1. An overall knowledge on how infrastructures are managed and on the relevant legislation in each European country
2. A harmonized structure for a European virtual registry on cloud
3. Guidelines to the various stakeholders on how to implement the virtual registry on cloud
4. White paper on legal framework to make the European virtual registry on cloud compulsory in all countries

Implementation of virtual registry on cloud in 3 European countries (Italy, Portugal, Romania) through pilot project

5. Defined and tested structure for a European virtual registry on cloud to be adopted in Europe

Relevance to the EC Cloud Computing Strategy

With respect to the EC Cloud Computing Strategy, VIRGO contributes to:

1. Analyzing the 'state-of-the-art' adoption of the Cloud solutions and services in the area of infrastructural data management in EU countries
2. Identifying the Cloud architectural solution meeting both public authority, telecom and utilities needs, processes, methods and relevant IT standards
3. Enabling public authorities to offer enhanced cloud services toward enterprises (Telecom, Utilities, SMEs) and citizens through efficient accessibility to infrastructural data and innovation in new services
4. Public authorities and industries, including universities, are involved to cover different angles of the Cloud opportunity, and to pilot and demonstrate the benefits of Cloud Computing in real conditions, to suggest a common way forward in terms of sustainable business models

Relevant Standards for Interoperability and Portability

The VIRGO solution adopts the following standard:

- OGC in particular WFS, WMS
- INSPIRE directive
- HTML5, CSS3
- SOA Architecture
- BPMN 2.0
- HTTPS

Plans for Sustainability and Business Models

The project will analyse these in WP8 "Exploitation…" planned in 2015 and 2016.

According to our current analysis, VIRGO is expected to bring:

1. Efficiency in PA and next Utilities and Telecom infrastructural deployment projects
2. Opportunities for 'revenues' coming from new innovative services

Quantitative analysis of potential efficiency and revenues is part of WP8, in collaboration with public authorities, even including the opportunity to identify structural funding programs to step up from pilot to a fully deployed service phase.

Links and References

The address of the project website is www.virgoregistry.eu

Social accounts of VIRGO were launched:

Facebook (https://it-it.facebook.com/VIRGORegistry),
Twitter (https://twitter.com/VIRGO_Registry),
LinkedIN (https://www.linkedin.com/profile/view?id=322545594&locale=it_IT&trk=tyah2&trkInfo=tas%3Avirgo%2Cidx%3A1-1-1)
and Google+ (https://plus.google.com/100067484647603270049/posts).

The project started 1 January 2014 and its duration shall be 36 months, so it will finish 31 December 2016.

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