Cloudscape Brazil 2015

FEDERATING CLOUD E-INFRASTRUCTURES AND CREATING NEW MARKETS

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Federating Cloud e-Infrastructures and Creating new Markets

December 2015

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Welcome to Cloudscape Brazil 2015

Welcome to Cloudscape Brazil 2015. This is now the second event organised within the remit of the EUBrazil Cloud Connect project, which has received funding from DGCNECT e-infrastructure and the Brazilian government under the 2nd coordinated call – Europe - Brazil.

Cloudscape Brazil 2015 is an excellent opportunity to share insights on co-operation activities between Europe and Brazil, and celebrate the successes to date, highlighting the fundamental role that cloud federated infrastructures play in enabling researchers tackle major social challenges. It is also an opportunity to present new co-operation activities under the third coordinated call, learn about research and innovation on cloud technology in Europe, and see how businesses from different sectors are benefitting from cloud services in both Brazil and Europe.

Brazil and Europe are long-standing partners in research and innovation, engaging in

joint calls for proposals since 2010, previously under the 7th Framework Programme and now under Horizon 2020. Bilateral Agreements for Scientific and Technological Cooperation and other dialogues supporting collaboration on research and innovation in diverse ICT domains have been instrumental in securing investments.

Building the Digital Single Market means revitalising European industry with a strong focus on cloud computing and the data economy. However, we still need to invest in cloud technology to fully realise its benefits, driving also a common understanding of best practices, such as security and data protection, to build the trust and confidence in cloud services that is currently lacking.

An open, international dialogue with all relevant stakeholders is critical for building consensus and shaping the practical steps necessary to overcome barriers for use by businesses, public organisations, researchers and consumers.

RNP, the Brazilian research and education network, has played an active role in both the coordination of the upcoming EU & BR coordinated calls as well as monitoring the strategic construction design of the submarine cable between Lisbon, Portugal and Fortaleza Brazil, as part of its capacity dedicated to education and research, under the Bella project.

The promotion of innovative technologies has been a major focus in recent years and further advances in information and communication technologies will significantly benefit the social and economic potential of Europe. We know the Brazilian government has recently implemented fiscal policies favouring ICT investment and fast wireless broadband take up. Europe, on the other hand, has set out ambitious goals in the field of telecommunication and digital policies, including fast broadband connections for all citizens and ultra-fast connections for at least half of all citizens by the end of the decade.

In terms of knowledge and skills creation, research collaboration is an important pulling factor of job creation in Europe and Brazil, with a constantly growing collaboration between the two regions since 2012.

Major international research organisations have on-going research activities with Brazil. There are also collaborative efforts on common IT standards across different disciplines. Large national actors are contributing to defining joint strategies on data sharing in sectors such as agriculture and biodiversity, where Brazil provides unique sources of data. The Research Data Alliance (RDA) is a global alliance to facilitate sharing data openly across technologies, disciplines, and countries to address the grand challenges of society. RNP is directly involved in this alliance and RDA should be seen as a further platform for collaborative cooperation between the two regions.

Cloudscape Brazil, 1-2 December 2015, is the forum for taking stock of progress to data, and shaping a common future on shared priorities, but it is just the first step. Dialogue must continue

between all stakeholders with an interest in transforming society and the economy through the cloud and big data. We invite all of you to continue engagement with Cloudscape Brazil, and from early 2016, with the EUCloudBrasilFORUM, which will be organising future workshops.

We would like to thank Microsoft for being our Gold Sponsors, our hosts, RNP, supporters, OW2, Cloud Security Alliance Brazil and media partner Science Node.

We wish the participants, keynotes, speakers, panellists and chairs a fruitful and engaging event.

Taking the vision for Open Science global

A new collaboration model for an Open Science Cloud between Europe and Brazil

Author(s): Marco Vieira (University of Coimbra), Silvana Muscella (Trust-IT Services), Sara Pittonet Gaiarin (Trust-IT Services), Jim Clarke (Waterford Institute of Technology)

Focus

Four short-term tactical recommendations for EU-Brazil co-operation priorities and common programmes. Insights from Brazilian and European policy makers. The Oct. 2015 position paper entitled European Open Science Cloud for Research. EUBrasilCloudFORUM.

Who benefits and how

A priority policy action for Europe and Brazil co-operation for the 2016 time-frame should be defining and scoping a public, open cloud infrastructure that all scientific researchers can use in an integrated way, the so called "Open Science Cloud". Within this priority area, EUBrasilCloudFORUM is going to contribute in a strategic way to the definition, scoping and creation of an EU-Brazil Open Science Cloud. The project will facilitate the establishment of an organisational co-operation model that enables the EU and Brazil to formulate and develop a common strategy and approach for Research & Innovation in Cloud Computing in line with the priorities of each region.

Spotlight

A priority policy action for Europe and Brazil co-operation for the 2016 time-frame should be defining and scoping of a public, open cloud infrastructure that all scientific researchers can use in an integrated way, removing silos. The European Open Science Cloud, which is part of the Digital Single Market strategy, will offer researchers from all disciplines a seamless, open access to the advanced digital capabilities, resources and expertise needed to collaborate and to carry out data-and computing-intensive science.

The Oct. 2015 position paper entitled European Open Science Cloud for Research presents a shared vision for the European Open Science Cloud. The position paper details eight elements for the Open Science Cloud's success, namely that it be open, publicly funded and governed, research-centric, comprehensive, diverse and distributed, interoperable, service-oriented and social. Brazil and Europe can capitalise on EUBrasilCloudFORUM as a channel to exchange views on the digital economy and on how different stakeholders can come together to implement a collaboration model for an Open Science Cloud between Europe and Brazil.

EUBrasilCloudFORUM has already identified the following recommendations.

Extending the Open Science Cloud Model to Brazil. In Brazil, individual universities and research institutes are currently using or implementing their own internal IT systems and services, including cloud services, and ranging from commercial providers to in-house approaches. The Brazilian research and education network, RNP, wants to invest in expanding its data centre cloud infrastructure through partnerships with institutions interested in participating in a Federated Community Cloud. Rolling out its own public infrastructure should remain a top priority. We therefore feel that Brazil should play a role in understanding how the EU's Open Science Cloud model can be imple-

mented in Brazil, with a view towards achieving their objectives in establishing a public cloud infrastructure for the science community. The short-term tactical recommendation is that MCTI should assign an organisation to sit on the meetings of the Open Science cloud.

Engaging the user community. In order to support the creation of an Open Science Cloud, it is important to capitalise on the cloud-related projects funded under the coordinated calls, e.g. EU Brazil Cloud Connect, EUBRA-BIGSEA and SecureCloud, focusing on developing cloud based services, while also using the results produced under the Open Science Cloud infrastructure, which can be rolled-out to the user community in Brazil also. **The short-term tactical recommendation is that the projects should be strongly encouraged to assist in integrating and developing cloud-based services that could be used on the Open Science Cloud federated public community cloud network, when available.**

Improving the "Co-ordinated Calls". The EU-Brazil collaboration model running the "Co-ordinated Calls was first established in 2010 and has been fine tuned in subsequent calls. Still, there are aspects that could be improved to ensure the future sustainability of the research results and potentially support the industrial and market uptake. They include: availability of funding; participation and evaluation rules as well as calendars for joint actions supported by EC and MCTI/CNPq; balance of the composition of EU-Brazil consortia; practical aspects regarding management procedures and regional support for applicants. Attention should also be paid to other funding opportunities and potential synergies with some of the CONFAP members e.g. FAPESP, FAPEMIG, for joint call efforts with a view to ensuring additional funds for future EU-Brazil calls. Likewise, EU Member States might also be a source of funding with a number of bi-lateral co-operation activities being explored between EU Member States and Brazil e.g. Ireland - Brazil. **The short-term tactical recommendation is that EC and MCTI should address these aspects when drafting the next round of Co-ordinated Calls.**

Re-define topics for cooperation: Future calls should take into account the main challenges in Computer Science identified by the Brazilian Computer Society (SBC), the analysis of the views and opinions of different stakeholders, collected via an online survey , and the capabilities and expertise of both European and Brazilian scientific communities. **The short-term tactical recommendation is that topics to be included in the future calls should be organised around three main groups**: 1. Management of information over massive volumes of open distributed data. 2.. Computational modelling of complex systems. 3. Technological development of systems focusing on key quality attributes, namely dependability, security, scalability and ubiquity.

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Co-operation Success Stories: Europe and Brazil

A federated platform for cardiovascular simulation services

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Focus

EU-Brazil Cloud Connect federated cloud infrastructures for research and science: cardiovascular simulation services at the bleeding-edge of science.

Who benefits and how

The cardiovascular simulation platform will benefit cardiologists and researchers who collaborate by giving them advanced modelling solutions. A novel set of tools will allow cardiologists to gain a better understanding of the phenomena involved in the interaction between the cardiac dynamics and systemic conditions through the simulation of different scenarios. On the other side, researchers will benefit from the extended capabilities of two existing modellers: Alya Red and ADAN, to create new models with increased scientific relevance. Future uptake of the simulation environment includes integration within the Hemodynamic Modelling Laboratory (HeMoLab), an online tool for simulating the human cardiovascular system developed by National Lab for Computer Science (LNCC), and with a Big data visualisation tool developed by the Computer Applications in Science and Engineering (CASE) department at the Barcelona Supercomputing Center.

Spotlight

The heartbeat is a phenomenon that involves several scales and different problems that are tightly coupled. This means that diverse orders of magnitude are linked, from the microscopic cell arrangement into a spatial description, to the macroscopic shape of the cardiac chambers. Also, different types of physical problems are involved: the propagation of the electrical stimuli in the cardiac myocites; the contraction of these cells that produces the deformation of the macroscopic geometry; and the effect of this contraction in the fluid contained on the chambers including the reciprocal force of the fluid against the walls of the cavity. Thus, we can say that the heartbeat is an electromechanical phenomenon in which the mechanical part involves a fluid-structure interaction (FSI) problem. In turn, the circulation of blood in the arteries is also an FSI problem resulting from the pumping effect of the cardiac muscle driving the blood flow through deformable vessels. Because of the scales involved, this becomes a wave propagation problem in which pressure and flow waveforms travel throughout the system.

EU Brazil Cloud Connect leverages the integration of heterogeneous supercomputing and virtualised infrastructures with the orchestration of two simulation codes from Brazil and Spain through the components integrated in the platform.. This innovative approach addresses the two complementary problems of Cardiac Electromechanical Modelling and Arterial Blood Flow Modelling. The simulation platform for the cardiac model is Alya, which is BSC's in-house simulation tool. Alya System is a Computational Mechanics code with two main features. Firstly, it is specially designed for running with high efficiency standards in large-scale supercomputing facilities. Secondly, it is capable of solving different physics in a coupled way, each one with its own modelling characteristics: fluids, solids, electrical activity and others.

LNCC has developed an Anatomically-Detailed Arterial Network (ADAN) model starting from ana-

tomical data and physiological concepts in order to perform cutting-edge cardiovascular research supported by modelling of physical phenomena and simulation-based techniques. Among other features, ADAN incorporates, in the definition of the vascular topology, most of the arteries which are acknowledged in the medical and anatomical literature for an average male.

The integrated simulation environment includes two deployment scenarios on the Federated EU Brazil Cloud Connect infrastructure: the execution of parametric runs on a cloud infrastructure and the execution of coupled runs of high definition simulations on distributed HPC resources. For the cloud implementation, an application has been developed using the BSC COMPSs Programming Framework, to orchestrate the execution of the AlyaADAN coupled simulator. High definition runs use HPC resources at BSC and LNCC coordinated by the CSGrid middleware, and the coupling is obtained through a connector in the cloud that regulates information flow between the two models over the network and across organization boundaries. The mc2 platform provides a common user interface for these different types of runs.

Without the Infrastructure developed within the EU Brazil Cloud Connect project, the scenarios described above would not have been possible. The architecture used for the parametric studies is essential to understand the physiological behaviour of the intrinsic processes of the heartbeat. Finally, the distributed high definition runs of Alya and ADAN will lead to the most complex and comprehensive model of the cardiovascular system available today. **Website**: www.eubrazilcloudconnect.eu | @EUBrazilCC

Cardiovascular simulation Platform: http://www.eubrazilcloudconnect.eu/content/cardiovascular-simulation-services.

A Scientific Gateway for integrated data analysis and research on biodiversity and climate change

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Focus

Cross-border collaboration through e-infrastructure services; integrated data analysis; climate change; biodiversity, LULC (land use, land cover) change indicators.

Who benefits and how

Earth observation and spatial-temporal analysis techniques are increasingly being made available to the public domain. We combine different data sources and analytic tools into a single, user-friendly Scientific Gateway supporting multi-disciplinary research on biodiversity and climate change research. Practitioners, decision-makers, educators and scientists working in governmental and commercial agencies can benefit from information that is analysed across various temporal and spatial scales to reconstruct the past, monitor the present and predict future landscape responses, particularly in the domains of hydrology, agriculture, forestry, earth science, biology and environmental conservation.

Spotlight

The Earth is a dynamic system which acts upon complex interactions of the atmosphere, biosphere, and soil. In order to advance our knowledge of these dynamics, and to predict what effects natural processes and human activity will have on biodiversity, ecosystem services, and livelihood, we need a detailed understanding of the interdependencies of such environmental systems.

The increase in data availability, wealth of analytic tools, and growing computational capacity offer unique opportunities for multi-disciplinary research to tackle key questions raised in the climate change debate. Cross-continental collaboration enabled by EU Brazil Cloud Connect integrates a wide variety of data sources and analytic tools into a user-friendly and web-based Scientific Gateway.

This Scientific Gateway is backed by the PDAS (Parallel Data Analytics Service), which provides a framework for parallel I/O and data analysis, storage and distribution of large scientific datasets. The framework has been extended with specific data analytics operators and primitives to fully meet the use case requirements. A set of VMIs has also been prepared to deploy the PDAS in private cloud environments. PDAS is fully interoperable with the EGI Infrastructure as well as with OGC-based environments.

The Scientific Gateway provides access to various sources of data, including multi-spectral satellite imagery (Landsat), laser altimetry data (LiDAR) and plant distribution occurrences. Landsat provides global imagery (30x30m grid cells) at frequent time intervals with information of spectral reflectance in visible and infrared wavelengths. The Surface Energy Balance Algorithm for Land (SEBAL) algorithm has been implemented to automatically translate spectral responses into temporal proxies, such as surface albedo, land surface heat fluxes and vegetation products such as NDVI, EVI and leaf area index.

In addition, high-resolution laser altimetry data (LiDAR) and analytic tools have been implemented to derive detailed terrain metrics (e.g. terrain elevation, slope angle, aspect) and forest metrics

(e.g. canopy height, aboveground biomass, vertical biomass distribution). Moreover, vegetation occurrences provide input for Species Distribution Models (SDMs) and simulations of vegetation response to changes in biodiversity, land use and climate parameters.

Experiments have been carried out to demonstrate the strong potential of the Scientific Gateway. SEBAL data provides indicators of Land Use/Cover (LULC) trends. Additionally, SEBAL output data can be input data for hydrologic models such as evapo-transpiration time series. To provide such data, a method is required that combines global and local remote sensing datasets that should be calibrated with field observations and existing climate measurements.

Efficient computational capacity to run the complex workflows on huge data sets is also required. OpenModeller provides observations about species data occurrences in the targeted areas of Brazil. In this regard, species occurrences provide information about the presence of some species in a specific area. Laser altimetry data analysis is implemented for the Adolpho Ducke Forest Reserve, a 10,000 ha protected area near the city of Manaus in Brazil, representing an undisturbed tropical rainforest.

We have demonstrated that through point filtering techniques 3D forest structure is visualised at the scale of individual tree crowns and branches, showing the complexity of multi-layered rainforest. This forms the basis for detailed change analysis and monitoring, particularly when combined with other climate indicators and SDMs. In summary, the EU Brazil Cloud Connect Scientific Gateway gives users access to massive datasets, processing algorithms and visualisation tools. It is designed to integrate these components for analysing the multi-disciplinary nature of earth science systems, particularly dynamics related to biodiversity and climate change.

In the near future, larger, more frequent and more detailed data will become available, which can be directly implemented in the current infrastructure for near-real-time data processing and visualisation. This will increase public awareness of land degradation or improvement, and also helping practitioners and decision makers to respond quickly to changing environmental conditions which, in turn, increases the sustainability of land management.

Website: www.eubrazilcloudconnect.eu | @EUBrazilCC

Link: http://www.eubrazilcloudconnect.eu/content/biodiversity-and-climate-change.

Integrating Tecgraf's CSGrid System to Microsoft Azure Cloud for Batch Job Submission

Author(s): Gama, Daltro S.; Rodriguez, Noemi; Lima, M Julia

Focus

The work presented in this position paper is the result of a master thesis developed at the Computer Science Department of PUC-Rio in collaboration with the Tecgraf Institute. The thesis investigated and improved infrastructure services for business and research. The result achieved reinforces the potential co-operation benefits between research institutions and industry, leveraging from EU Brazil Cloud Connect project and Microsoft Azure platform., The Azure Batch is used to run large-scale parallel and high performance computing (HPC) applications efficiently in the cloud.

Who benefits and how

Tecgraf's CSGrid users interested in cloud-scale batch submission within the Azure public cloud infrastructure and developers interested in developing integrations with Azure infrastructure.

Spotlight

The CSGrid system is built as an instance of the CSBase framework developed over the last ten years by the Tecgraf Institute at PUC-Rio. It is used in production in a wide range of scenarios. CSGrid offers a collaborative and extensible environment to abstract the use of distributed computational and storage resources for High Performance Computing (HPC), providing functionalities that can be used both directly, by end users, or through programming interfaces.

CSGrid targets batch submission of non-interactive programmes previously uploaded and shared by the users using a project-centric environment: input and output data files are organised in project areas keeping the co-operation between users centralised over the same work space. Originally, CSGrid was designed for fixed-size clusters and grid computing purposes. Several scientific and commercial applications run in the CSGrid environment, including a few at the Brazilian oil company Petrobras, and some others at SINAPAD.

Our goal in this work was to develop an integration with Azure's public cloud platform by implementing a software module for CSGrid in order to explore the resource elasticity typically provided by cloud computing. Firstly, we evaluated the computing power of the Azure infrastructure by measuring basic network throughput and processing time for CPU-bound processes. The results met our expectations, especially when using D-series virtual machines provided by Azure.

The next step was to design a new module to address the integration between CSGrid and the Azure platform. We implemented this module using Azure's REST APIs to access services for blob storage, messaging, and virtual machine management. This new module gave CSGrid the capacity to explore the elasticity of the cloud platform, especially in bag-of-tasks workloads, with different policies, such as having as many virtual machines as queued jobs in order to minimise wall clock time or adapting the number of virtual machines based on the execution queue status.

Provisioning and deprovisioning policies were designed to minimise the financial costs of virtual machines as well as blob storage usage. The CSGrid-Azure integration was developed over a newly CSGrid API designed during the EU Brazil Cloud Computing project for integrating CSGrid to other platforms such as the Fogbow cloud federation, developed by Campina Grande Federal University (UFCG). This new API also encourages integration with other cloud APIs like OpenStack or Amazon EC2/S3. Recently, Microsoft also developed a batch execution platform called Azure Batch®.

The Azure Batch had not yet been released at the development time of CSGrid integration.. Microsoft's solution has similar requirements to those of CSGrid's batch execution, although Azure Batch's first release only allowed the execution of MS Windows binary programs, an inconvenience when working with CSGrid. However, in the future a new CSGrid module might be implemented to achieve integration with Azure Batch.

The experience of integrating Microsoft's Azure public cloud platform with Tecgraf's CSGrid system can be considered a successful exploration of CSGrid's new capabilities. It illustrates how far CSGrid, a system that has been commercially used for many years, can evolve and integrate with more contemporary technology. This work was made possible by Microsoft Research Award Program in 2014/2015.

Website: www.eubrazilcloudconnect.eu | @EUBrazilCC

Microsoft Azure Batch:

https://azure.microsoft.com/en-us/documentation/articles/batch-technical-overview/

EU & BR New Co-operations under H2020

Building Consensus on Cloud for Innovation and Growth through a Dialogue between Europe and Brazil

Authors: Marco Vieira (University of Coimbra), Silvana Muscella (Trust-IT Services), Sara Pittonet Gaiarin (Trust-IT Services), Jim Clarke (Waterford Institute of Technology)

Focus

EU-BrasilCloudFORUM, a Collaboration and Support Action starting in early 2016. Establishing an engagement forum for policy, research and innovation dialogues between Europe and Brazil through a community-driven approach. An EU-Brazil research and innovation roadmap and action plan on cloud computing. A web-based EU-BR service platform promoting and marketing the results and services from research and innovation.

Who benefits and how

Collaborative research between Europe and Brazil is an obvious opportunity to add value to cloud services and applications and services via innovative practices and to make use of innovation as a tool to access and position themselves into new and existing markets, as well as high-level jobs. In its rapidly growing economy, there are opportunities for Brazil to become a cloud computing hub. What's more, with Brazil being the largest economy, the largest technological market and the largest land mass in Latin America. Cloud computing is also an opportunity for Brazil to become the hub for cloud in the region.

Spotlight

Europe has outlined a cloud computing strategy that is expected to deliver a EUR160bn boost to its economy. Creating a Digital Single Market means revitalising European industry with a strong focus on cloud computing and the data economy. Its cloud computing strategy focuses on the main challenges identified: safe and fair contract terms and conditions (security certification schemes and security SLAs) and standardisation while boosting uptake through a European cloud partnership. EU-funded initiatives on cloud computing make trust, security, open source and open standards top priorities.

The Brazilian government recognises the importance of cloud computing and has put it on the agenda for priority development at the Ministry of Science, Technology and Innovation (MCTI), the national research and education network, RNP, has defined its strategy for cloud computing based also on an analysis of other NRENs in Europe and is a leader in networking Latin America. The Brazilian government is discussing the legal environment for international requirements in security, interoperability, privacy, and sovereignty over data.

Through a structured community-driven forum for EU-Brazil dialogue on policy, research and innovation, EU-BrasilCloudFORUM will systematically link together policy, research, user requirements, and open standards to boost innovation and growth across markets in Brazil and Europe.

EU-BrasilCloudFORUM will identify and deliver a EU-BR vision and strategy for cloud research and innovation that requires between both regions. To achieve this, it will liaise with the Brazilian Computer Society (SBC) on the creation of a Special Interest Group on Cloud Computing that leverages the expertise in academe and industry to shape future research directions. The outcome will be a joint research and innovation Roadmap and Action Plan.

EU-BrasilCloudFORUM will build an online EU-BR service-oriented platform to promote and market the results from EU-BR collaboration on research and innovation in cloud computing. It will offer a space for cloud service providers to help match supply and demand. The platform will gradually incorporate new offers from R&I projects, especially open source software and open standards, as well as establish links with the FI-WARE node in Brazil. It will also ensure links with CloudforEurope and PICSE, transferring expertise and tools to the Brazilian public sector.

EU-BrasilCloudFORUM will connect the different stakeholders through EU-BR policy dialogue, Cloudscape Brazil annual events, cooperation workshops and major EU-BR conference events. These events will zoom in on different aspects of cloud computing, such as security, certification, service level agreements (SLAs), cloud contract legal tips, the regulatory environment, and new disruptive business models.

An Opinion Leaders Group comprising a balanced mix of experts from academic and research institutions, industry, government, and standardisation. The Group will provide timely insights in their respective areas of expertise, ranging from trends and policy priorities for technological, political, and regulatory developments in cloud computing.

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BIGSEA: Data Analytics on top of Quality of Service Cloud Computing Infrastructures for Massively connected societies

Author(s): Ignacio Blanquer (Universitat Politècnica de València), Wagner Meira Jr. (Universidade Federal de Minas Gerais)

Focus

This position paper focuses on the creation of research networks leveraging cloud services and co-operation between Europe and Brazil, with the potential for creating bridges and transfer impact between the two regions. . In this context, we expect European cloud and Big data solutions to cater for demand from Brazilian researchers, thus creating durable co-operation activities in the area of Quality of Service for clouds, among others. Brazilians can benefit from the opportunity to extend their data processing models to other datasets and populations in Europe.

Who benefits and how

EU-Bra BIGSEA will develop a framework for ensuring the Quality of Service (QoS) of data analytics services on top of cloud infrastructures ensuring security and privacy. Application developers will benefit from application porting, data analytics, automatic elasticity and big data privacy services to faster develop big data applications.

EU-Bra BIGSEA will also develop a user scenario focusing on massive connected societies. This scenario will be based on the BIGSEA services to develop novel strategies and techniques for efficiently integrating multidimensional layers of heterogeneous data, with different standards, data types, time scales, geographical coverage, and data quality, all of great interest for the general public.

Spotlight

EU-Bra BIGSEA, "Europe – Brazil Collaboration of Big Data Scientific Research Through Cloud-Centric Applications" is a project funded under the third coordinated call Europe – Brazil by the European Commission and the Brazilian Ministry of Ciência, Tecnologia e Inovação to create a sustainable international (European and Brazilian) co-operation activity in the area of cloud services for big data analytics.

EU-Bra BIGSEA sets out to address the main issues of Quality of Service in cloud infrastructures for big data analytics. Predictive models for vertical and horizontal elasticity will be developed for both computing and storage, exposing simplified programmatic interfaces to upper-layer applications. Public clouds offer customised high-level services for data analytics, which depend on specific features of the provider. This reduces the capability of migrating the virtual appliances from one provider to another.

BIGSEA will use standards on the specification of Virtual Appliances (such as TOSCA) and a plug-in based support of multiple infrastructures (including major providers of public and on-premise clouds) to reduce vendor lock-in. High-level data analytics services will provide a console and will expose APIs for their usage from standard programming models, transparently to the user. Users are expected to be able to deploy their own customised elastic virtual computing infrastructure on top of their data storages.

The use case for validating the platform focuses on city traffic analysis, exploiting data from multiple and heterogeneous sources. The project plans to develop novel strategies and techniques for efficiently integrating multidimensional layers of heterogeneous data, with different standards, data types, time scales, geographical coverage, and data quality. It will use the platform to propose,

instantiate and validate novel descriptive modelling methodologies for GES3 data considering its temporal, spatial and dynamic nature. These analyses will be used to understand the relevant relationships and patterns inherent to traffic, environmental and user data.

BIGSEA will also build prediction models that support route recommendation, as well as traffic and public transportation planning. The models will leverage the QoS and security capabilities of the BIGSEA platform for exposing the service to users. Finally, security on Big data is an issue that requires a major cooperation and development. Traditional data security measures are not efficient when applied to the large volumes and high velocities of Big data, which requires different approaches and technologies.

Website: http://www.eubra-bigsea.eu/ | @bigsea_eubr

FUTEBOL: Federated Union of Telecommunications Research Facilities for an EU-Brazil Open Laboratory

Author(s): Cristiano Bonato Both, Juliano Wickboldt, Marcelo Marotta, Nicholas Kaminski, Johann Marquez Barja, and Luiz DaSilva

Focus

Federated cloud infrastructures for research and science - applications addressing social challenges, big data value, open standards - EU-Brazil co-operation priorities and common programmes.

Who benefits and how

FUTEBOL targets four main groups: (1) new experimenters who can take advantage of advanced experimentation enabled by FUTEBOL research infrastructure and tools, bringing business value to their organisations and helping them speed up their innovation. (2) Innovators and researchers both in the academic and corporate research and development domains working on resource allocation and optimisation in wireless and optical networks. (3) Telecommunication manufacturers, telecommunications operators and service providers, such as, but not limited to, members of the public-private partnership for 5G (5G-PPP), and organisations participating in the recent Horizon 2020 ICT calls. (4) Society as a whole including students, regulators, standards groups, etc.

Spotlight

FUTEBOL will create research infrastructure and tools that enable and promote the federation of experimental telecommunication resources irrespective of their location in Brazil and Europe, with a view to global experimentation across heterogeneous networks, both wired and wireless, and a variety of end-systems. It will build on current tools and platforms in support of end-to-end experimentation, creating a pool of, and giving open access to, shared network experimental resources that complement those available in each continent.

Industrial and academic researchers in telecommunications have recognised the need for flexibility, intelligence, and the efficient use of resources. These requirements are exemplified by the broad range of technologies being proposed for inclusion into the fifth generation of cellular networks (5G).

Furthermore, existing overarching strategies stress the intelligent combination of techniques to flexibly use available resources, both wireless and wired, in the most efficient way. In this sense, FUTEBOL is an experimentation platform that will support the joint optimisation of optical network scheduling and radio resource management. Such a platform is required for experimentation-based exploration and validation of several 5G technologies (e.g. cloud radio access networks, cell densification, etc.) and the efficient use of the optical backhaul.

The development of a coherent toolset to support joint control of wireless and optical networks in an experimentation context is among the objectives of FUTEBOL, including:

1. Creating a toolset to enable experimentation at the wireless/optical network boundary.
2. Providing these tools to an array of experimental facilities that support experiments in both wireless and optical networks in an open manner.
3. Contributing to open research questions in optical/wireless using the tools developed in the project.

The basic experimentation toolset created in FUTEBOL will consist of a defined environment that

allows users to focus directly on their problems of interest with minimal overhead. As such, a common experimentation architecture, relevant to issues that cross the wireless/optical network boundary, is the core of this toolset. The architecture will enable coordination between wireless and optical networks, defining interfaces to provide a standard method of communicating control and management data between each type of network.

The toolset based on these elements will support experimentation by providing both a realistic model of real deployments of wireless/optical integration points as well as additional experiment monitoring capabilities that may not be available in real deployments. Furthermore, the toolset must be portable across test beds to provide a consistent framework independent of the particulars of a given facility. FUTEBOL will also provide open access to the developed tools, through methods such as those defined by the Fed4FIRE project.

How EU research funding is being rolled-out into the market

ARTIST, A tool-supported method to cloudify applications

Author(s): Clara Pezuela (ATOS), Leire Orue-Echevarria (Tecnalia)

Focus

ARTIST is about modernising old applications to convert them into services for the new generation of business in companies. ARTIS facilitates the migration of these modernised applications to the cloud, previously analysing the feasibility of such migration, from a technical and business perspective, and mitigating the costs and risks in the decision to move onto the cloud.

Who benefits and how

ARTIST targets two main market sectors. Firstly, IT consultants who will adopt the tools and incorporate them into their own offerings, most likely oriented around application portfolio management. This will be the case for the larger industrial partners in the consortium. Secondly, there is a market segment which will contract ARTIST-based services from these providers. These are Independent Software Vendors and other owners of bespoke software systems that require modernisation to the cloud. In particular clients requiring the modernisation of several related software programmes will be targeted. In some cases these end clients can perform the modernisation themselves using the tools, providing they have the right IT skills set.

In both sectors, the benefits for the end users are similar. On one hand, the migration encompasses less risks due to a previous feasibility analysis. On the other, the effort for transforming the product is reduced thanks to the guided process and semi-automatic tools provided by ARTIST.

Spotlight

Migrating software to cloud infrastructure may be sufficient most of the time. But residing in the cloud is not enough to make an application fully scalable, elastic and 'cloudy'. For maximum performance and efficiency, the software code itself must be modernised.

Using model-driven techniques, ARTIST facilitates the modernisation of your existing non-cloud software assets and your business model to the cloud. ARTIST provides a tool-supported methodological migration process consisted in three main steps:

1. Performing a technical and business feasibility analysis with support in the decision making of whether it is viable to move to the cloud or not, in terms of technology and cost.
2. Gathering the knowledge and understanding of your application to optimise it and adjust the business model so it can be deployed on the best cloud provider for your needs.
3. Validating the behavioural equivalence of the migrated application and the fulfilling the optimisation requirements, with the option to certify that it is cloud-complaint.

The main result of the project is a tool-supported methodology to assist software companies in the migration of their applications to the cloud. This methodology is customised to the specific migration project and consists of three main phases: feasibility analysis, migration and verification.

In the feasibility analysis phase, ARTIST provides several tools that analyse the technical and business viability of the migration, helping in the decision of whether the migration is worthwhile or

not. Then, in the migration phase, through reverse engineering, we gather the knowledge and understanding of the application. Through forward engineering, we re-factor and optimise the existing application and adjust the business model so it can be delivered on the cloud. Furthermore, we help users in selecting the best cloud provider for their needs, by profiling their applications. Finally, during the verification phase, we validate the behavioural equivalence of the migrated application and the fulfilment of the optimization requirement. On top of this, we certify that it is cloud-complaint and monitor the availability of the cloud service once the application is deployed in the cloud.

Along the migration process, two languages have been developed: the goal modelling language (used for modelling the migration goals in the pre-migration phase and verified in the post-migration phase) and CloudML@ARTIST, which is an extension of CloudML language focused mainly on application level modelling.

The ARTIST business strategy is based on the ARTIST Club, which is a perpetual, self-financed initiative, which will generate business opportunities for its members, and reduce the costs of both the continuation of the ARTIST software assets as an Open Source project, and for the organisations commercialising them. The ARTIST club ensures that a strategic roadmap and detailed work plan are used to guide the future developments in ARTIST, also covering issues such as quality assurance, maintenance and schedule releases.

The ARTIST club will provide a mechanism through which current and future organisations that incorporate the OS results into their offerings, and researchers investing in further developing the software assets can offer mutual technical and financial support and ensure a consistent and strategic evolution of the results. Membership is open to anyone wishing to help steer the future of ARTIST.

Website: http://www.artist-project.eu/ | @ARTISTeu

CLARUS - Towards trust in cloud computing services

Authors: Josep Domingo-Ferrer (Universitat Rovira i Virgili, URV), Roberto Cascella and Stephanie Parker (Trust-IT)

Focus Area

The cloud is giving private users, businesses, organisations and the public sector access to highly sophisticated IT systems and applications that would otherwise be out of reach to them. But there is still some work to do for Europe in the Cloud for it to really take off.

A key goal in this respect is having a common understanding of best practices in Europe – for example, on data protection and security. Such a common understanding will raise confidence and create trust, thereby boosting the uptake of cloud services and applications throughout all sectors of the economy.

As part of the European Cloud Computing Strategy, Europe is continuing to invest in cloud technology to truly benefit all sectors of the European economy, especially in sectors where Europe has a major interest and leadership, such as health.

The main objective of the CLARUS project (January 2015 – December 2017) is to enhance trust in cloud services by developing a secure framework for the storage and processing of data outsourced to the cloud. CLARUS will allow end users to monitor, audit and control the stored data without impairing the functionality and cost-saving benefits of cloud services.

Who benefits and how

The CLARUS framework will benefit both users and providers of cloud services and applications. On the one hand, the CLARUS solution will increase trust in the cloud by potential cloud customers like companies, public organisations and e-government administrations. These groups will be more motivated to embrace the benefits of trusted cloud services while retaining full control over any potentially sensitive data they outsource to the cloud. On the other hand, cloud service providers can benefit from a trust-enabling solution like CLARUS that broadens the spectrum of potential cloud users. This represents an important market opportunity for cloud providers. In the long term, initiatives like CLARUS can pave the way to developing more transparent, standardised, auditable and controllable cloud services, which will be beneficial for all stakeholders.

Spotlight

Cloud computing certainly provides great benefits to end users, but it has been built on the assumption that appropriate security and privacy-preserving techniques are implemented by cloud providers. However, recent security breaches of well-known cloud services (e.g., Sony Playstation Network outage, Apple iCloud celebrity photos leakage) have revealed the risks of uncontrolled data outsourcing. As a result, the trust of end users in cloud services has been seriously undermined and users with really sensitive data (e.g. healthcare data) are extremely reluctant to outsource their data.

As highlighted by the European Commission and several Cloud-related working parties, a model change is needed to tackle this serious issue. The new model should return to data owners the control over their data and should foster cloud services based on standards that can be certified as compliant with security and privacy.

The main goal of CLARUS is to improve privacy, security and trust of end users with respect to the cloud providers. To achieve this, the CLARUS solution is envisioned as a proxy located in a domain

trusted by the end user (e.g., a server in her company's intranet, a plug-in in the user's device) that implements security and privacy-enabling features towards the cloud service provider.

Overcoming the barriers to cloud adoption by addressing challenges of privacy, security and trust.

To enhance privacy, CLARUS will implement a set of privacy-enabling mechanisms to ensure that the user's sensitive data is properly protected before it is outsourced to the cloud. Protection will be provided in a way that cloud service functionalities are still preserved, even those that require performing operations (e.g., queries, transformations, calculations) on the protected data.

To achieve that, CLARUS will rely on and innovate over the current state of the art on functionality-preserving cryptographic (e.g., (partially) homomorphic encryption, searchable encryption, etc.) and non-cryptographic data protection techniques (e.g., data anonymisation, document redaction, data splitting and merging, private information retrieval, etc.), with a special focus on preserving the benefits associated with cloud services (functionality, cost-effectiveness, efficiency, etc.).

To enhance trust, CLARUS will also implement a set of auditing services, so that users can directly supervise how data is being protected and outsourced to the cloud. To enhance security, CLARUS will also develop an attack-tolerant framework, so that potential security breaches within the cloud can be dynamically detected and appropriate mitigation measures can be activated on-line.

In this way, the user's privacy, security and trust can be significantly enhanced with respect to current cloud security solutions both regarding honest-but-curious cloud providers and potential attackers (insiders as well as outsiders), while still preserving cloud functionalities, and within the Platform-as-a-Service, Infrastructure-as-a-Service and Software-as-a-Service models.

Interoperability and portability: existing and emerging standards that can foster trust in the cloud

The CLARUS project proposes to develop the above-described framework as a set of generic protocols that can be used by collaborative cloud service providers in order to build trusted cloud services that are standardised and, therefore, transparent with regard to data management, privacy and security.

To do so, within the CLARUS project, a set of communication interfaces and protocols will be designed:

» Between the end user and the CLARUS proxy.

» Among different CLARUS instances running at different organisations.

» Between the CLARUS proxy and the cloud service providers.

The aim is that the interfaces and protocols should be generic and cover most of the spectrum of cloud services, so that they can be proposed as cloud standards. By means of standardisation, protocols and functions can be made homogenous for cloud providers and CLARUS proxies, so that:

» Interoperability can be achieved across otherwise heterogeneous cloud providers.

» Collaborative services (e.g., edition of documents outsourced to the cloud by several users) can be implemented through several CLARUS proxies.

» APIs based on standards can be made available to programmers for a seamless development of end-user cloud-based applications.

Website: http://www.clarussecure.eu/ | @CLARUSecure

Ultra-Scalable Cloud Database

Author(s): Ricardo Jimenez-Peris (tech. coord.), Marta Patiño (coord.) & CoherentPaaS consortium

Focus

CoherentPaaS is creating an ultra-scalable cloud database as a cloud service for business. It provides the full functionality of an OLTP (On Line Transactional Processing) database with full SQL full ACID support scaling from 1 to 100s of nodes. It also provides integration with NoSQL technologies such as key-value data stores, document-oriented data stores and graph databases. The integration lies in providing global transactions and queries across SQL and all these NoSQL data stores.

Who benefits and how

The end users of the ultra-scale cloud database are businesses (B2B), large companies or small tech firms that need a scalable cloud database or need to integrate SQL and NoSQL technologies.

Spotlight

One of the main issues companies face when deploying their applications in the cloud is the lack of a scalable database. This limitation forces companies into relying on sharding, a technique that lies in using multiple independent database instances and storing a fraction (shard) of the data on each of them. Unfortunately, sharding is extremely expensive for most applications, requiring a lot of coding effort and expertise. CoherentPaaS solves this problem with the LeanXcale ultra-scalable database, enabling to scale transparently applications deployed in the cloud. This novel approach makes sharding redundant.

Another common issue for companies using cloud databases and data stores is that they need to resort to a combination of data management technologies SQL and NoSQL. They use SQL for their operational data and resort to NoSQL data stores for specific needs on the flexibility of the data model and the appropriate query language/API. This is what is so-called Polyglot Persistence, a term coined by Martin Fowler in his bestseller NoSQL Distilled. In this Polyglot world there are two main painpoints. The first one is related to the updates.

If a business operation requires updating more than one data store, today, there are no data consistency guarantees. If there is a failure, the "logical database" consisting of all data stores will get inconsistent with some partial updates on only a fraction of the data stores being updated. CoherentPaaS solves this problem firstly, by providing transactional semantics to NoSQL data stores lacking it. And secondly, by providing global transactions across data stores. In this way, applications can get the same transactional data consistency guarantees across data stores as they had in old SQL world.

The second pain point is that when companies want to correlate data across data stores, it becomes impossible since they speak different query languages/APIs. CoherentPaaS has adopted a unique approach that enables to combine SQL and the native query languages of the different NoSQL data stores to support queries across them.

Website: http://coherentpaas.eu/ | @coherentpaas

PaaSage - making cloud usage easy

Author(s): Lutz Schubert, Jörg Domaschka, Pierre Guisset

Focus

Cloud services for business: Though modern cloud solutions are geared towards ease of use, most require a considerable amount of in-depth knowledge to actually use the respective infrastructures and services to their full potential. What is more, maintenance of these infrastructures is difficult and thus hardly allows small businesses to compete in the market by offering their own infrastructures or services. The PaaSage project is specifically geared towards start-ups, SMEs and even larger companies to easily develop and deploy cloud applications, as well as to provide and extend their own infrastructures.

Who benefits and how

PaaSage capabilities are demonstrated through a number of showcases, including enterprise resource planning, eScience, the automotive industry, financial services, but also the public sector. The application scope of PaaSage is large and generally allows fast and efficient development and management of applications and infrastructures in any sector. End-users currently employing PaaSage technologies include be.wan IT Solutions, AGH University of Science and Technology, Automotive Supercomputing Center Stuttgart, EVRY Norway, Lufthansa Systems and many more.

Spotlight

Modern cloud providers aim at a wide range of customers, thus making cloud usage theoretically easy. The truth is, that whilst deploying and managing services is principally easy, controlling and optimising them is not. In fact, most providers completely rely on best effort approaches and/or the application developer's skills to make use of any additional features. This not only requires high-level expertise in using the specific provider, it also necessitates high-level knowledge in cloud-based application development and management, which generally does not exist – simply for the reason that the necessary business and software engineering expertise is generally lacking. Finally, it will, by default, lock the developer into the provider platform.

The PaaSage project improves application deployment and maintenance by incorporating business knowledge into a middleware that helps deploy, control and maintain applications. PaaSage thus allows developers to specify applications in the form of their structure and constraints, much rather than on the level of individual rules and configuration details. As such, developers can, for example, specify which general requirements, including types of services and hardware configuration need to be fulfilled and the PaaSage environment will try to find the best deployment of the application parts across a set of potential providers and their respective quality criteria and capabilities.

PaaSage will furthermore help in developing best fitting rules to ensure that the requirements are maintained at runtime, by scaling the application, migrating it or reconfiguring the environment. Additional criteria such as maximum cost can thereby act as delimiting factors to avoid mission-critical failures. The PaaSage execution environment will support deployment and configuration of the application services across a range of cloud providers, without the need for developers to (understand and) specify new configurations or to write new deployment scripts to ensure that the deployment and configuration is carried out correctly.

The environment will furthermore ensure correct enactment of the rules at runtime and mainte-

nance of connectivity between application tasks, again without the need for developers to know the differences between different offerings. This allows developers to easily develop and specify distributed, modular applications where each module can be deployed and maintained separately whilst still observing the overall constraints and requirements. The environment thereby allows full control as well as distribution over multiple cloud providers. For this, PaaSage brings:

1. An application specification model and (2-4) a 3 layered platform: the CAMEL cloud modelling specification allows definition of modular applications and their specific requirements.
2. An intelligent "upperware" layer to convert the specification into a set of deployment configuration files that meet the overarching requirements.
3. The actual middleware that triggers the deployment and allows integration of monitoring data to supervise the behaviour and take actions for adapting the configuration if any properties are no longer met.
4. The executionware ensuring the actual deployment and configuration, as well as enactment of the different application modules.

Website: www.paasage.eu

How Federation, Standards & Interoperability play a vital role in cloud Computing

HTML5Apps: Cloud and web standard Roadmap

Author(s): Daniel Dardailler

Focus

Presentation of a roadmap focusing on Web standards that are of particular relevance to Cloud Computing research and development.

Who benefits and how

This roadmap allows Cloud-related R&D projects to more easily keep track of and participate in on-going W3C work.

Spotlight

Cloud And Web Standard Roadmap: As part of our HTML5Apps project , we have identified a subset of R&D EC projects with an interest in the development and adoption of HTML5 standards. We put a particular focus on platform as a service (PaaS) projects that defined APIs. Analysis of and outreach to the projects revealed that a significant number of HTML5 standards have the potential to play an important role in Cloud technology, but this is not widely known due to a "communication gap" between the Web and the Cloud communities.

There was also a lack of understanding of how the projects could use them (or use them better), depending on their degree of maturity, implementation, or other deployment criteria. To address this, we developed a specialised version of the general HTML5 roadmap focusing on on-going work of particular relevance to Cloud Computing research and development. This roadmap allows Cloud-related projects to more easily keep track of and participate in ongoing W3C work.

Web and Cloud roadmap: The "Standards for Web Applications on mobile roadmap" is a resource that informs all Web programmers, on a quarterly basis, of the evolution of Web standards particularly relevant to mobile. This document aims at facilitating the adoption of the Open Web Platform as a target developer platform for ICT research projects among others. It gives information about status, deployment, etc. of different HTML5-application standards in development at W3C. Here we look at the foundations described in the roadmap of HTML5 standards and describe their relevance with respect to Cloud computing.

Core Web Design and Development:

The Graphics and Layout layers are not very relevant for the Cloud programmers, they are part of the UI considerations. That being said, the Web provides a valuable portable layer for Cloud application UIs, allowing Cloud researchers to concentrate on the PaaS/IaaS level. W3C work on IndexedDB and background synchronisation create a good combination needed for Cloud storage so it is something Cloud designers should track.

Media and Real-Time Communications: Increasingly, sharing/streaming media is a big use case for cloud technologies, as the cloud makes everything faster and appear closer on the net, large binary objects in particular. The natural distribution of media on a given Web page, coming from different servers, in different authenticated streams, should lead to a Cloud friendly architecture but Cloud designers are not always at the table in HTML5 standardisation to raise their requirements.

Usability and Accessibility: Although focused on UI as well, Cloud programmers should pay attention to MMI, the multimodal interface activities of W3C, since in addition to integrating multiple UI modalities, e.g., GUI, speech, touch and gesture, the scope of the latest charter of the multimodal interaction Working Group includes combination of cloud services and multiple input/output modalities provided by more than one devices. For more details, please see the MMI Ecosystem report.

Device Interaction: A primary use case for Cloud technologies in the near future will be to handle data gathered from the myriad of sensors that get build and distributed in devices all over the planet. Web technologies can increasingly be used to interact with these sensors.

Network Integration: All work in this area is relevant: synchronisation, push, socket, XMLHttpRequest, are all used in cloud agents and need to be tracked by c:loud R+D projects for new features.

Application Lifecycle: While Cloud services are potentially always in operation, their usage by end-users depend on their proper integration in the clients that they interact with, whose lifecycles depend on many parameters: battery, network connectivity, visibility on the device, etc. These notions are part of the overall application lifecycle: how applications get installed, shown to the user in applications list, started, stopped, woken up from remote notifications, synced up when the device goes on-line. These various capabilities have brought the Web platform through different mechanisms such as Packaging on the Web or the JSON-based manifest format and the HTML5's ApplicationCache work.

Payment and Services: HTML5App's new W3C activity on payment is already looking at Cloud integration, e.g. differences between eWallets that reside in your phone or in the cloud, or more generally any payment card details managed either on a secure element or on the cloud. Of course, the things people buy online, the actual data or resource may be outsourced to a cloud service provider and so communication and protocols must be developed in this context.

Performance & Tuning: Concerns mostly the Web itself, but the cloud being a performance driver as well, there may be connections to make.

Security & Privacy: Clearly a big intersection with the Cloud, and all Cloud programmers should follow this work if they want to write secure cloud web apps, concerned with identity, encryption, etc.

Web of Things: The Web of Things, a new W3C activity, is also very relevant, as it focuses on servers ranging from micro-controllers to cloud based server farms where large numbers of sensors, high message through put and big data are very much to the fore. W3C's contribution in this area focuses on metadata as an enabler to implementing an abstraction layer that sits above the platforms and protocols, a bit like the Web itself sits on top of lower level Internet protocols. Also worth mentioning, most of the Cloud Computing API work is based on URIs and REST, concepts developed by the W3C and IETF, so these needs to be tracked as well. And so does our recent work on Efficient XML, EXI, which is used by a lot of frameworks for exchanging structured data.

Summary: In developing this new roadmap resource, we aim at lowering the risk that PaaS-based Web applications restrict overall Web application portability. There is an opportunity for the W3C to use its experience in standardising Web technology to aid PaaS web application portability and define how Web applications can be structured to utilise cloud resources. There are a number of existing development efforts within the W3C which could be leveraged and we hope that researchers will take these opportunities to strengthen their platform.

Overall, we see two core issues which currently limit PaaS application portability and that we hope using the Web platform can help solve. First, the variety of model abstractions for traditional cloud resources makes it hard for developers to create applications which can port easily between PaaS providers.

Second, even though using Web technologies in a pervasive way, e.g. URI and REST, or HTML5, looks like a guarantee of compatibility between platforms, the approach taken by Cloud environments does not provide application portability for PaaS and developers still have to re-implement their application code in a different development language to move between PaaS providers supporting different languages.

Conclusion: For the Cloud technology to be open and interoperable across Europe, but also across the entire Internet, it has to rest on other open standards. Cloud applications that use native APIs, proprietary to a particular vendor, will fail to deliver true portability. We have focused our attention on R&D projects defining APIs for the cloud (PAAS layer usually), and on ways to help them consider the HTML5 and Open Web Platform as a natural complementary to making PAAS software and standards as open as the Web. As a result, we have produced a version of our HTML5/Web standard roadmap with a specific view on Cloud relevance, to raise awareness within the Cloud R&D community on the importance of the Web platform for their projects.

Website: html5apps-project.eu/ | @AppsHTML5

HTML5 roadmap: w3.org/Mobile/mobile-web-app-state/

Current Cloud and Web roadmap: http://www.w3.org/2015/09/HTMLApps-D3.4/cloud.html

From project objectives to Cloud interoperability, or: How to quickly group and classify vast numbers of projects - CloudWATCH

Author(s): Michel Drescher, Neil Caithness & David Wallom

Focus

Federated cloud infrastructures for research and science - applications addressing societal challenges, big data value, open standards.

Who benefits and how

The methodology addresses the challenge of quickly and effectively assessing a large and complex landscape of activities and quickly finding structural patterns in that landscape. Typical beneficiaries of such methodology are many fold:

» Funding agencies that need to make an informed decision whether to fund a certain project or not: The methodology can assist and provide some of the much needed information.

» Cloud service providers can use the methodology to determine which of their potential customers align well with their own priorities, and are thus good candidates for converting an initial contact to a paying customer - it saves time and effort in selecting the best opportunities.

» Cloud research projects can use the methodology to determine which other projects to contact and discuss overlapping interested to make the most out of the taxpayers' money that fund their activities.

» Cloud Standards Setting Organisations can use the methodology to quickly assess how to compose or facilitate the composition of a Working Group to stay focused on their ultimate goal.

Spotlight

The EC FP7 supported CloudWATCH project, as part of its work programme, was required to reach out and create a community from a large number of projects with multiple stakeholder groups in the Cloud computing landscape (whether EC-funded or not). The aim was to gather relevant information about their priorities and objectives in Cloud computing, and to turn that information into a profile of relevant standards. Relatively quickly, the partners discovered that this would be impossible to reach with the then available tools and methodologies.

In addressing this problem, CloudWATCH broke down this process into three major methodologies that are reliable and repeatable. The first methodology includes a phase of input data gathering, where stakeholders scored their project objectives on a numeric scale against a set of Cloud characteristics as defined within the NIST model of cloud computing.

That raw material was then analysed and processed by combining several well-known and accepted statistical methods for data analysis. The outcome provides a fast and efficient grouping of projects with sufficient overlap in priorities and objectives, showing where the projects analysed sit in the landscape, highlighting the characteristics important to them, as well as showing technically synergistic clusters of projects that will allow for quicker establishment of communications between projects who are technically aligned.

The second methodology takes these groupings further by applying Cloud computing architecture elements to these groupings, mapping candidate standards into it, and finally crystallise the results into "straw-man" documents that facilitate discussion among grouped projects for a common approach on interpreting and implementing affected standards, and thus, eventually achieve interoperability.

Finally, the last element in this approach is to validate the available solutions post-implementation and apply software testing and quality assurance procedures to it, in collaboration with other Cloud interoperability projects and activities, such as the Cloud Interoperability plugfest initiative led and organised regularly by OGF representatives.

The CloudWATCH2 project (funded by the EC H2020 programme) will continue the work of the initial CloudWATCH project in further refining the methodologies, and promote their uptake and collaboration on all its aspects with international partners, following IEEE P2301 lead in this field.

Website: www.cloudwatchhub.eu | @CloudWatchHub

Cloud Standards Profile Development:

http://www.cloudwatchhub.eu/sites/default/files/D4.3_Final-report-on-Cloud-standards-profile-development_vFinal-Update1_0.pdf

FitSM: Agile and lean service management the cloud way!

Author(s): Michel Drescher

Focus

Cloud services for business - realising the innovation and growth potential for start-ups, SMEs and big corporations

Who benefits and how

FitSM is a time and cost saving IT service management (SM) framework, originally developed in a federation context. FitSM is suitable for any organisation wishing to save time and costs in implementing, consolidating, or even optimising their IT service management system (SMS) by combining all its important aspects in a meaningful manner: SM best practices, SMS process requirements, quality management, capability & maturity assessment, auditing. FitSM as a framework is freely available under a Creative Commons license, and comes with many guides, templates and examples.

Spotlight

"When is good' going to be good enough?" FitSM is an IT service management framework that has been originally developed by the FedSM project. Since the end of the project, FitSM is owned and managed by the German not-for-profit IT management training organisation ITEMO e.V.

With Cloud computing becoming ever more popular in the IT industry, one cannot but wonder how all these Cloud services are managed at adequate and sustainable service levels. Obviously, there are collections of best practices, and related standards for IT service management such as ITIL, ISO/IEC 20000 and others. However, these standards and specifications were written and developed in the IT service delivery era prior to Cloud computing, and in a world that is becoming agile and embracing lean methodologies, there is a clear need for a response in the IT service management discipline that fits in well in the overall cloud computing business model.

Cloud computing is all about being agile, elastic and responsive business models, and so should be the IT service management system. FitSM answers the question given at the beginning by meaningfully combining elements of ITIL, ISO/IEC 20000, ISO/IEC 27000, ISO/IEC 9000, CobIT and CMMI into a complete yet succinct set of specifications covering everything that is needed for an effective IT service management system covering all important aspects such as:

» Which processes need to be put in place?
» What are the minimal requirements for my service management system?
» Who is responsible, accountable, consulted or informed?
» Who does what in which process, procedure and task?
» How mature is our system compared to our target level?
» How can we assess our progress, and ensure continual improvement?

FitSM provides these in easy to digest specifications, and puts these into context with ancillary guides, templates and samples for implementers to get immediately started. Through its development in the academic setting and being supported by the European Commission, FitSM by nature took concerns and requirements of public administrations, academic institutes, and public policy makers into account. Therefore FitSM is designed to scale well from small service management systems to large deployments. Particularly, FitSM took heed of the needs of small academic insti-

tutes that provide services to their own communities, where professional (vulgo "near-perfect", and expensive) service management is not an option.

Website: http://fitsm.itemo.org/ | @FitSM_Standard

Capitalising on Open source and New Services in the Cloud

We are in the Cloud age

Author(s): Alfonso Ríos Alonso

Focus

Some of the main drivers encouraging companies about thinking of Cloud models for their business are the flexibility, the increasing productivity and a cost-efficiency related to new models oriented to services. Several companies do not have enough resources and the proper knowledge to create and maintain advanced systems to fulfil its technological needs, to do so they put all this issues on expert hands without losing the control to manage its data in a unified way.

Who benefits and how

Cloud services are a very interesting alternative for big companies, SMEs and start-ups which need to gain efficiency for its management process and IT budgets. Companies from different vertical sectors are aware of the advantages they can get from Cloud and they are orienting its processes and systems to a Cloud model to leverage and obtain a competitive advantage.

Spotlight

It was in 1947 that the world came to learn about the amazing invention of the transistor but did not yet know the incredible impact it would have on their daily lives. Like that, many innovations have come to stay.

Today we are in the Cloud Computing age, one of the major technology tendencies that imply a generational change. Companies from different sizes start to understand how this paradigm can impact its IT budgets and what could they do to get benefits from this model. But most changes are not immediate; each disruptive technology brings with it the need for adaptation to take advantage of new ways on how services are provided. Similar to the giraffes who had to evolve into a long neck in order to reach the highest branches of trees, companies that want to get up-to-speed with Cloud progress need an open mind to face changes attached to a service orientation and adapt themselves to new processes where they can see how traditional limitations are reduced.

Today, customers want to access technology services in an agile, secure, flexible and scalable way, with costs that they can control and if that's not enough, packaged and customised services available in just a few clicks. All of these attributes match with Cloud promises, a cost efficiency model of IT resources where CAPEX and OPEX savings are evident as well as offerings of applications ready to go and a pay per use model. But to address all of this, a transition process is required, where, at the beginning, we have to combine traditional and Cloud models to provide a hybrid delivery that allows customers not only manage data from its own data centres but also using public infrastructure. Regardless of whether customers want to use public, private or hybrid Clouds, they must not lose sight of the fact that they need to understand which platforms worldwide have real cloud assets to guarantee that services can be provided in a consumption model, with elasticity to consume resources based onneeds, fault tolerance, high availability, multitenant (service provision to several clients from a single infrastructure), scalability, and in the end a native Cloud Computing platform ahead of any misuse of the term or Cloud concept.

On this basis, Indra has its own Cloud assets called the GPaaS Suite, which offers an innovative and agile service model for developing and using applications in the cloud. This suite of products has been featured in Gartner Magic Quadrants on four occasions: in the Visionaries MQ under the "Enterprise Application Server" and "Enterprise Application Platform as a service" categories between 2009 and 2.015.

Indra has the knowledge and experience to provide a comprehensive end-2-end offer of solutions and services including consulting, the transformation of applications and the development of new services. To reach the innovation as a central axis to successful organisations and as the basis for economic growth, we need to create an ecosystem where companies can count on technology partners who help them identify the best strategy to adopt new models, and also to give advice on a proper alignment of business needs and Cloud services opportunities. This is what ultimately attracts customers to join this new age in search of gaining efficiency and competiveness of its business.

Website: http://www.indracompany.com/en | @IndraCompany

How organisations of all sizes can benefit from their in-house cloud infrastructure – the case of USTO.RE

Author(s): Rodrigo E. Assad, Leandro M. Nascimento, Manuella Samarcos

Focus

Cloud infrastructures; Cloud services for business

Who benefits and how

Companies of all sizes planning to acquire cloud software to maintain their own cloud infrastructure and not depend on other big players; cloud entrepreneurs developing strategies to leverage their cloud services by enhancing security and keeping in-house all processed data; government and/or public companies, which need to maintain citizen information inside a country's borders, avoiding espionage and improving national security; practitioners and enthusiasts of cloud computing.

Spotlight

The scenario of cloud computing has reached a critical point. Several companies of all sizes around the world need to make a hard decision at some point of their existence: "do we keep using could services from big players like Google or Amazon, or do we maintain our own cloud services in-house?" This question brings up many other variables including data security, quality of services, and mainly: cost. Even a small sized company that needs to keep 24/7/365 on-line servers are spending a lot of money on third-party cloud services.

This position paper defends the idea that it is possible for even small-sized companies to have their own in-house cloud services with good quality, high security and at a low cost. There is a high up-front investment for purchasing servers, network devices, large-scale storage and other equipment. However, it is still less costly than paying for third-party services over a long period of time.

To show some evidence of this scenario, a Brazilian company called USTO.RE has been developing a set of products and demonstrating that it is possible to avoid depending on big players to maintain cloud infrastructures. Nowadays, USTO.RE has five different software solutions to the growing needs of several companies:

» **Corporate e-mail**: uMail is the software to keep corporate e-mail at maximum security. It uses cryptography for all exchanged messages, it allows access to contact list and calendar and integrate to a customised storage tool that allows that all the attached files are saved properly in a virtual drive.

» **Cloud storage**: uStorage/uDrive are two products that controls any file backups and versioning inside the corporation. Both use P2P technology to faster file transmissions and improve disaster recover, once files are replicated in peers. In addition, uDrive uses iSCSI technology to improve file transfer speed.

» **Cloud infrastructure manager**: uCloud is the product to control in-house data centres, including virtual machines, network and storage management. uCloud brings up several ways to deal with different commercially known hypervisors, such as, VMWare ESXi, Xen Server and Openstack. It is a complete solution to manage cloud infrastructures.

» **Desktop virtualisation**: integrated to uCloud solution, uVDI allows that every collaborator of a given company has its own virtual desktop. This means that the company would not need to provide a computer for every employee, reducing costs of ownership and maintenance. Using solution like uVDI, it is possible to instantiate within minutes, several virtual machines with the

same configuration for hundreds of employees, without the need to allocate technical personnel to configure each desktop.

» **Corporate and cryptographic chat**: uConnect is a solution for instant messaging using cryptography to exchange messages in a secure way. uConnect also allows that groups of interest are formed and all instant messages inside a corporation would not be seen by anyone.

USTO.RE has many clients around Brazil, including government and private companies. Its practical experiences have proven that it is possible to maintain in-house cloud services at a lower cost than hiring third-party specialised companies.

Website: http://usto.re/

Competitive Advantages with Open Source Cloud Infrastructure Solutions

Author(s): Miguel Koren Brien de Lacy

Focus

Cloud services for business - realising the innovation and growth potential for start-ups, SMEs and big corporations.

Who benefits and how

Directors and managers of businesses and public sector organisations that need reliable and low cost access to solutions stand to benefit by running their business software in the cloud, be it public, private or hybrid. Konsultex has implemented private clouds based on the Xen hypervisor for enterprises, helping businesses and the public sector to achieve competitive advantages.

Spotlight

Pressures on organisations to reduce costs while increasing efficiency is becoming more and more important in the face of the current economic climate, globalisation and economic interdependence, and especially in Latin America. This situation companies into more rounds of cost cutting so that their employees can be more efficient.

Organisations need software that is always available, usually from anywhere, secure, dependable, scalable, energy efficient and cost effective. Cloud computing tends to be a privacy and security concern for some companies because they see that their data resides outside the organisation. There are also concerns about availability if the cloud hosting provider suffers downtime. While this issues can be considered in contracts, it is really hard to mitigate the risk of the provider closing shop or being shut down by a government security agency.

The traditional IT model in a business environment means that companies run software in their data centre and are responsible for hardware, energy, backup and maintenance for many physical servers. Each server is not normally used to its full capacity. Open source software solutions have normally not been on the cutting edge of any specific field. They tend to offer comparable features to their commercial counterparts but without the licensing costs.

Open source solutions are usually more reliable, standards compliant and have quicker solutions to bugs, which makes them very attractive to most businesses. In some areas though, open source solutions lead and offer features earlier before the commercial world. Cloud Computing is a good example of this, so implementing cloud computing with open source software makes a lot of sense.

One very well known cloud platform is Xen Server which became open source in 2014. Xen Server offers a platform to build a company's cloud infrastructure in the data centre. A company concerned about their data leaving its premises does not need to worry with Xen Server, because a private cloud can be implemented, hosting the virtual servers on hardware that runs in the company's own data centre so that everything stays in house. This means that the company gets all the benefits of cloud computing infrastructure and open source software with the features that the Xen Server offers. While companies are however still responsible for supplying energy backups and maintenance, they can still make better use of their hardware. Deploying a new server is much faster and problem free because no new hardware needs to be acquired. All this leads to savings and increased reliability.

Konsultex has helped companies achieve these benefits in the past several years with minimal or

no downtime during implementation.

Website: http://www.konsultex.com.br/

Customer centred, customer's experience

Author(s): Roger Williams & Michel Drescher

Focus

Cloud services for business - True customer experience is centred around the customer's own journey, not the interaction between a potential supplier and their customer. This paper illustrates how truly customer centred experiences differ, and how this will impact both the design of cloud services, and how cloud services can support the customer and the supplier to build better understanding of customer experience. Organisations that embrace this approach typically experience rapid growth and are able to harness the power of their advocates.

Who benefits and how

SMEs can benefit by directing customer communications and relationships in new ways. Shaping demand for products and services resulting in dramatic business growth. Customers of all kinds will benefit by being given far more fulfilling experiences when using products and services, as they increasingly meet expectations and deliver value to the customer.

Spotlight

Customer experience is an industry term that is generally used to describe how a customer is managed at each point of interaction with a supplier or service provider. A wide range of cloud based tools have emerged to support this increasingly important business function. However social media, comparison sites, review sites, digital marketing, inset marketing, standard and new media marketing have grown to compliment traditional networks and personal recommendations, the way in which customers needs, expectations and satisfaction can be stimulated or reviewed has changed dramatically.

A conventional 'customer satisfaction survey' can demonstrate that the supplier 'did what they said they would do' but the customer could still have a very negative perception of that supplier. The ability to accurately understand the customers perspective requires the development of customer centred and possibly industry centred Cloud based services that capture and shape customer demand and reactions to products and services, providing invaluable resources for SMEs to tune their approach to delivering a highly effective customer experience. This overall approach is called Intelligent Linking and the Customer Experience is captured in the six step cycle described below.

This paper seeks to stimulate Cloud service providers to consider ways in which truly enlightening customer experiences can be captured and shared for industries.

The Intelligent Linking Customer Experience Cycle is:

Awareness: How does a customer become aware of a need or requirement for a product or service. What stimulates that need or demand?

Attention: From all of the emergent needs that a customer has, what motivates a person to pay attention to a particular need and creates the 'intention' to do something about it?

Access: When seeking to fulfil this need how does a customer go about reviewing the options and choosing the right product or service for them?

Action: When the need is being fulfilled how does a customer ensure they get the most out of a product or service?

Achievement – What is the customers perception of achievement? What value was generated for

them and did this fulfil the expectation set at the 'Attention' stage?

Advocacy: When reviewing their experience is a customer a positive or negative advocate of the service, and how motivated are they to share this opinion and shape future demand?

The challenge is to build services to capture insights from the customer and the supplier perspective and to work to align these perspectives to ensure the best possible customer experience for all.

Recommended Reading

Digital Single Market

http://ec.europa.eu/priorities/digital-single-market/

European Open Science Cloud

Digital Agenda for Europe on Open Science

https://ec.europa.eu/digital-agenda/en/open-science

Science Node: Working Towards European Open Science Cloud

https://sciencenode.org/feature/working-towards-european-open-science-cloud.php

Trusted and Secure Services – Europe

CloudWATCH: A Portfolio of Offers for trusted and Secure Services – From cloud computing and software technologies into innovative services for the European digital single market

http://www.cloudwatchhub.eu/sites/default/files/A-portfolio-of-offers-for-trusted-and-secure-services_Web.pdf

Cloud and Security

Cloud certification schemes

https://resilience.enisa.europa.eu/cloud-computing-certification

ENISA - Cloud Security for SMEs

https://www.enisa.europa.eu/activities/Resilience-and-CIIP/cloud-computing/security-for-smes/cloud-security-guide-for-smes

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