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Inter-Cloud Research: Vision for 2020

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Abstract

Inter-cloud Challenges, Expectations and Issues Cluster objective is to enable collaboration among European Research projects addressing topics of multi-cloud and inter-cloud. Today these projects analyze the question from diverse perspectives and focusing on specific parts of the problem. This position paper provides the work done in collaboration by all these projects to define research areas and challenges for 2020. It identifies a Cluster's vision of Inter-Cloud topics development by 2020, as well as, research areas in order to realize the provided vision. An extended version of this work is available on the Inter-Cloud Cluster position paper [1,2].

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1. Introduction

Inter-cloud Challenges, Expectations and Issues Cluster goal is to create a critical mass of European Research projects addressing the topic of multi-cloud and inter-cloud, in order to share experiences, collaborate on approaches and discuss challenges for adoption and future research[1]. Inter-Cloud or Multi-Cloud is defined as the serial or simultaneous use of services from diverse providers to execute an application[3].At business level, Hybrid Cloud is the term commonly used, Gartner[4] defines hybrid Cloud as the coordinated use of cloud services across isolation and provider boundaries among public, private and community service providers, or between internal and external cloud services. This simultaneous or serial use of services from diverse heterogeneous clouds is a challenge in order to

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further develop the Cloud market in Europe. While it presents a series of issues with regards to interoperability among heterogeneous cloud typologies, private and public clouds, services' comparability, portability, migration, networking, etc. It also offers innovative market opportunities for the development of new roles in the cloud market related to hybrid cloud models. This paper reflects part of the work conducted by the cluster focusing on identifying Cluster's vision of Inter-Cloud topics development by 2020, as well as, identifying research areas and its prioritization in order to make the provided vision, reality.

2. Vision

Despite the achieved advances and commercial uptake, Cloud technologies and models have yet to reach their full potential. Many Cloud capabilities need still to be further developed and researched, so to allow their exploitation into a full degree. All along the Cloud stack (SaaS, PaaS, IaaS) commercial product developments today are based on proprietary solutions that drive to a vendor lock-in situation for the existing adopters. In this context, the realisation of multi-clouds is materialised though internal clouds and interactions between public-private Clouds which is hardly automatized. In addition, security, trust and legal compliance issues still act as barriers for a wider uptake. Whilst more developed Inter-cloud scenarios, such as Cloud Bursting, Cloud aggregation and Cloud brokerage exist theoretically, real implementations marginally exist and they are tailored for specific cases. To reduce the effort and time associated to the adoption of cloud, developers need to be able to develop an application regardless of where it is released, structuring and building it in a vendor agnostic way so that it is possible to deploy on the provider that best fits the requirements at the moment thus realizing the "develop once deploy everywhere" paradigm.

Today Cloud Computing market is still far from adopting an open and competitive model in which cloud resources act like in conventional markets. Lack of interoperability and adopted standards together with intricate regulatory context, inflexible pricing models and not adequate SLAs are recognised as the main obstacles to Cloud adoption. However, in order to realize a full Multi-Cloud market vision additional aspects need to be developed into Inter-cloud management such as: provisioning, metering and billing, privacy, security, identity management, fine grained QoS and Service Level agreements, consideration of diversity of resources (compute, data and network).

The use of standard or agnostic interfaces for cloud services would allow the developers to migrate cloud application among cloud platforms with minimum effort. This alignment need to be achieved at all cloud levels and across different models of clouds (including local/edge clouds). Automatic porting of existing applications and software systems (in particular legacy systems) from on premise platforms to a cloud platform need to be supported by suitable methodologies and tools to facilitate and speed up the migration. It is solely with the full development of these novel capabilities and when real interoperability among cloud providers will become a reality through the adoption by market leaders of existing or innovative standardisation efforts, that new scenarios of business opportunities will emerge both for existing and new stakeholders in Cloud computing and EU Single Digital Market for European businesses. This will allow for the exploitation of multi-cloud models to their full potential, enabling the shift from a product centric provision into a service-oriented economy in a rich Cloud ecosystem. In this ecosystem customer-driven dynamic composition of cloud services will allow to provide customer-tailored complex services, creating economic value from the interconnection of diverse and heterogeneous service providers that jointly contribute to an integrated solution that meets individual customer needs. This will target a Cloud Ecosystem where freedom of choice prevails for the customer and where all cloud stakeholders (Cloud Service Providers, Software Vendors and Telecom operators) leverage and multiply the benefits of each other taking into account the EU Single Digital Market for European businesses. Automatically discover and compose cloud service at different levels (e.g., business process, software, infrastructure) in order to satisfy application or business requirements, will enable not only the fast development of applications and business processes for the cloud, but also their runtime adaptation, when the respective need arises, thus catering for dynamism.

The advent of these models will bring significant challenges to customers, in which IT provision will deploy a hybrid IT model going beyond conventional approaches. For several decades, customers and providers have relied on stable delivery approaches, customized architectures and solutions and traditional commercial models, with outsourcing at the heart of their offerings. In a multi-cloud market, enterprise IT services will not be organized neither only in-house nor completely outsourced, instead will be located at some optimal point between the two and