Abstract. Cloud computing is the emerging technology in distributed, autonomic, service-oriented, on-demand, trusted computing. The fact that several Cloud solutions have been implemented so far, such as Amazon EC$^2$ and S$^3$, IBM's Blue Cloud, Sun Network.com, Microsoft Azure Services Platform, etc., is evidence of the great success already achieved by this computing paradigm. On the other hand, an increasing number of research projects focus on Cloud (Nimbus, OpenNEbula, Eucalyptus, OpenQRM, RESERVOIR, etc.) thus confirming that the topic is really hot, attracts investments and funds, and involves more and more researchers.

Our idea of Cloud has been synthesized into Cloud@Home, a computing paradigm that supports both open and commercial communities. Starting from the contribution philosophy at the basis of the Volunteer computing paradigm, we imagine a Cloud built on off the shelf, independent, network-connected resources and devices owned and managed by different users. Such users can both sell and/or buy their resources to/from Cloud providers or, alternatively, they can share them with other users establishing open interoperable Clouds.

Being aware of the crucial and driving role played by the RESERVOIR project in defining and implementing a reference architecture for Cloud computing, in this paper we focus on how to adapt and use the results of such project in the Cloud@Home specification. Starting from the RESERVOIR architecture, we discuss and detail how the Cloud@Home paradigm can be implemented on top of it, individuating components and modules to be integrated in a new reference architecture which allows to extend RESERVOIR towards the Volunteer contributing paradigm, improving SLA management and federation issues and, at the same time, enhancing virtualization and resources management in Cloud@Home.

Keywords: Cloud computing, Volunteer computing, cross-platform interoperability, RESERVOIR.

1 Introduction and Motivation

Cloud computing is a distributed/network computing paradigm that mixes aspects and goals of several other paradigms such as: Grid computing (... hardware

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and software infrastructure that provides dependable, consistent, pervasive, and inexpensive access to high-end computational capabilities" [1]), Internet computing ("... a computing platform geographically distributed across the Internet" [2]), Utility computing ("a collection of technologies and business practices that enables computing to be delivered seamlessly and reliably across multiple computers, ... available as needed and billed according to usage, much like water and electricity are today" [3]) Autonomic computing ("computing systems that can manage themselves given high-level objectives from administrators" [4]), Edge computing ("... provides a generic template facility for any type of application to spread its execution across a dedicated grid, balancing the load ...").

Cloud computing is a distributed computing paradigm derived from the service-centric perspective that is quickly and widely spreading on the IT world. From this perspective, all capabilities and resources of a Cloud (usually geographically distributed) are provided to users as a service, to be accessed through the Internet without any specific knowledge of, expertise with, or control over the underlying technology infrastructure that supports them. Cloud computing provides on-demand service provision, QoS guaranteed offer, and autonomous system for managing hardware, software and data transparently to users [8].

In order to achieve such goals it is necessary to implement a level of abstraction of physical resources, uniforming their interfaces and providing means for their management, adaptively to user requirements. The development and the success of Cloud computing is due to the maturity reached by the hardware and software virtualization and Web technologies.

A great interest on Cloud computing has been manifested as demonstrated by the numerous projects proposed by both industry and academia. In commercial contexts, among the others we highlight: Amazon Elastic Compute Cloud [9], IBMs Blue Cloud [10], Sun Microsystems Network.com [11], Microsoft Azure Services Platform [12], Google App Engine [13], Dell Cloud computing solutions [14]. Some scientific activities worth of mention are: RESERVOIR [15], Nimbus-Stratus-Wispy-Kupa [16], Eucalyptus [17], OpenQRM [18] and OpenNebula [19]. All of them support and provide an on-demand computing paradigm: a user submits his/her requests to the Cloud that remotely processes them and gives back the results. This client-server model well fits aims and scopes of commercial Clouds: the business. But, on the other hand, it represents a restriction for scientific Clouds, that have an open view [20,21], closer to that of Volunteer computing. Volunteer computing (also called Peer-to-Peer computing, Global computing or Public computing) uses computers volunteered by their owners as a source of computing power and storage to provide distributed scientific computing [22]. It is behind the "@home" philosophy of sharing/donating network connected resources for supporting distributed scientific computing.