

Position Paper: *Service Clouds as Future Internet Service Offers*

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Editor: Alex Galis (UCL); Contributors: Alex Galis (UCL) a.galis@ee.ucl.ac.uk, Thierry Priol (INRIA) thierry.priol@irisa.fr, Ignacio Martin Llorente (UCM) llorente@dacya.ucm.es

Service Clouds Session: <http://www.future-internet.eu/home/future-internet-assembly/madrid-dec-2008/fiso.html>

1. Introduction - Service Clouds in Future Internets

Cloud computing is a new style of computing in which typically real-time scalable resources are provided “as a service” over the Internet to users who need not have knowledge of, expertise in, or control over the cloud infrastructure that supports them. It is a general concept that incorporates Web 2.0, Grids, Virtualisation and Service Management technologies trends, in which the common theme is reliance on the Internet for satisfying the computing and networking needs of the users/consumers.

Service Clouds include a range of systems such as :

- Software as a Service (SaaS), which provides specific functional focus,
- Platforms in the Cloud (PaaS), which are environments to plug in software,
- Infrastructure Cloud (IaaS), which provides computing in the cloud and
- Virtual Private Cloud (VPC), which provides a slice of a Service Cloud for use and management by a user.

This position paper identifies the research orientation together with the key challenges for the capabilities and the systems in the *Service Clouds* part of the Future Internet Service Offer.

2. Service Clouds in Future Internets : Research Orientation & Grand Challenges:

This section summarises the important research challenges and opportunities for the definition and design of *Service Clouds* for Future Internets. The followings are the main areas where we feel research into the definitions and the design is required, as a starting point.

Resource Management Capabilities & Requirements

- Integration of Networking, Computation, Storage and Content virtual resources, together with the architectures, self-management, and controls of such resources, including the assessment of infrastructure adaptations based on context-awareness.
- Management of services (groups of Virtual Machines - VMs) with inter-connection relationship and placement constraints within and across sites
- Dynamic and scalable management of VMs and physical resources and elasticity support to meet variations in service workload
- Advanced placement algorithms with policies for SLA commitment
- Performance and reliability running scientific and business applications in Clouds
- Content distribution systems using Clouds
- Grid, HPC and data-intensive computing in Clouds
- SLA, privacy, security and pricing
- Management of network capacity
- Advance reservation of capacity

Infrastructure Capabilities & Requirements

- Programmable data and service centres for the provisioning of networking computational resources for service clouds.
- Provisioning of Slices of Service Clouds (i.e. Virtual Private Clouds)
- Large scale data management
- Development of new Programming models for Service Clouds (i.e. Extending existing ones or based on new paradigms)
- Self-* and autonomic behaviours are required for large scale deployment

- Infrastructures based on P2P instead of client/server
- Architectures for federation of sites and heuristics for capacity
- New Cloud interface exposing advanced functionality
- Provision across infrastructure sites
- Integration with infrastructures for Grid Computing
- New architectures for Cloud infrastructures
- Cloud interfaces, programming models and tools
- Heuristics for energy efficiency and high availability
- Higher value self-awareness, self-knowledge, and self-management capabilities
- Interoperability and portability between Cloud providers
- Open business policies framework for infrastructure providers relationship management
- Supporting the definition of open standards for cloud computing, to break the lock-in imposed by vendors

Service Management Capabilities & Requirements

- Service life-cycle management
- Request & control of (virtual) execution environments for a service;
- SLA & QoS repositories;
- Monitor and police SLA commitments at all levels;
- Monitor Context changes at all levels;
- Maintenance of Service related metrics and QoS;
- Trigger and manage migration/ configuration/ contextualisation of service components as function of changes in context and/or SLA; same or multiple domains;
- Assurance management;
- Accounting and billing management;
- Performance management;
- Open interfaces to service portals;
- Open business policies framework for service and infrastructure providers' relationship management (i.e. pay-per-use business model management).
- Cross-domain management functions, together with the design of cross-layer cooperative systems providing integrated management functionality of system lifecycle, self-functionality, SLA, and QoS
- Mechanisms for dynamic deployment of new management functionality without interruption of running Future Internet systems. The operations required will be Plug-and-Play, Unplug-and-Play, and (re)programmability
- Increased level of self-awareness, self-knowledge, and self-management capabilities (organisation, optimisation, configuration, adaptation, healing, protection, contextualisation) for Service Clouds
- Increased level of self-awareness of resource management, including discovery, configuration, deployment, utilization, control and maintenance.
- Self-awareness capabilities for minimizing system life-cycle costs and to minimise energy footprints.
- Orchestration and integration of management functionality.

General Capabilities & Requirements

- Adaptability
- Resiliency and survivability
- Robustness and stability
- Accountability
- Evolvability
- Scalability
- Reliability

- Trust and security
- Multi-domains
- Green servicing

4. Possible integration paths towards the Future Internet

The following steps for progress are envisaged:

- Proposals for Service Clouds architectures and systems for evolutionary and clean slate approaches aligned with visions of other cross-domain topics or FP7 projects.
- Proposals for Evaluation, Demonstrations and Interoperability.

5. Roadmap and Milestones

- Preparation of the “Service Clods as Future Internet Service Offer” Position Paper – based on FIA conference of 9th December 08 ; 16th January 2009
- System Functions and Requirements (SFR) Paper on Service Clouds: to be presented at the next FIA in Prague, 11-13 May 2009.

7. Contributors

Alex Galis (UCL) a.galis@ee.ucl.ac.uk,

Thierry Priol (INRIA) thierry.priol@irisa.fr,

Ignacio Martin Llorente (UCM) llorente@dacya.ucm.es