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Authors:	*Peter Mathews (CA), Arnor Solberg (SINTEF)*
Editor:	*Peter Mathews (CA)*
Reviewers:	*Danilo ARDAGNA (POLIMI), Stepan SEYCEK (BOC)*
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Executive Summary

This deliverable is the final report of the standardization activities completed in the MODAClouds project. It reports on the activities that have developed since the last report in Month 18. In this report we note a strengthening of effort in the Topology and Orchestration Specification for Cloud Applications (TOSCA) working group in the OASIS standards setting organization. This deliverable also reports on our observation of the further development of the Cloud Standards Coordination which is moving to the end of the second phase with four reports being edited during an October 2015 workshop. This deliverable also contains some details of related standards that are being observed or worked on and comments on the further standardization work that will be continued by consortium members influenced by MODAClouds but after the project has been completed.

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Members of the MODAClouds consortium:

Politecnico di Milano	Italy
Stiftelsen Sintef	Norway
Institute E-Austria Timisoara	Romania
Imperial College of Science, Technology and Medicine	United Kingdom
SOFTEAM	France
Siemens Program and System Engineering	Romania
BOC Information Systems GMBH	Austria
Flexiant Limited	United Kingdom
ATOS Spain S.A.	Spain
CA Technologies Development Spain S.A.	Spain

Published MODAClouds documents

These documents are all available from the project website located at http://www.modaclouds.eu/

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1 Introduction

1.1 Context, objectives and main achievements

Standardization efforts are a continual priority in MODAClouds and will continue beyond the end of the project. One area of particular interest is in the development of CloudML and the current interest that is being taken by the TOSCA working group.

The original findings of the Cloud Standards Coordination (CSC) were that the standards landscape in relation to cloud computing is not as poor as the press and analysts were saying. The gap analysis indicates that there a number of standards that are in development that will fill those gaps. The issue, as always with completing a standard specification is the time that it takes from idea to first draft to review and finally to recommendation. The work on TOSCA and CSC will continue beyond the project. CloudML is also gaining traction and has been presented to the TOSCA working group. Several members of the consortium are also members of TOSCA and CA Technologies has a member of staff as co-chair of TOSCA.

While the project and future work will be focussed on TOSCA and CSC this is not to say that these will be the only standardization efforts undertaken by consortium members, however these are worthy of remark as the main focus.

1.2 Structure of the document

This document expands on the work noted in D10.2.1. The first section deals with some general standardisation initiatives and developments. The second section notes the progress of the Cloud Standards Coordination that was started in 2014 and is on-going. Finally, the development of TOSCA is dealt with in some detail since there are contributions from several parts of the project.

2 General standardization activities and considerations

Standardisation is a continual focus for many organisations, in particular it allows software companies and application developers to future proof their work. As an example, CA Technologies is engaged in a number of standards setting organisations. The work enables a software company to ensure that standard recommendations does not hamper future markets for software and that interoperability between tools and software is less problematic.

CA Technologies is engaged in a number of areas that support the standardisation work in MODAClouds, for example CA is working with ISO/IEC on vocabulary and reference architecture of cloud standards but also working on SLA, portability and interoperability. Portability is particularly interesting in relation to the Smart Cities case study from Siemens in the MODAClouds project. In fact, portability is at the heart of the data synchronisation that is required for resilience in this case study

CA and other organisations are also involved in the Distributed Management Task Force (DMTF). Involvement in DMTF includes software defined data centre, cloud management work group and work in the area of cloud Audit. There are many other security, management, and open standards that are not cloud specific and as such are not mentioned in this deliverable.

One group that so far has eluded members from the consortium is the NIST service measurement group. This group used some of the work done on SMI, mentioned in the previous deliverable to build out a plan for describing methodologies/frameworks for metrics, vocabulary, and common reference architecture/taxonomy rather than than creating specific metrics. In this it differs from SMI and the cloud service description metrics based approach in MODAClouds Venues4Clouds and Tower4Clouds. The MODAClouds approach will, however, benefit from the NIST work in the future, giving a common way on describing metrics and thus cloud services. This work will continue in other projects, such as MUSA after the end of the MODAClouds project.

3 Cloud Standards Coordination

The Cloud Standards Coordination was reported on in D10.2.1. That deliverable reported on what became the first phase of CSC. The end of the first phase was also the end of MODAClouds active participation. CSC has been extended into another phase by DG-Connect as part of an ongoing initiative to improve and manage the cloud computing standards landscape and support Cloud Computing within the European Union. MODAClouds was an active member of the CSC working groups and final report delivery. A decision was taken that MODAClouds would be an observer in phase two rather than an active participant. The MODAClouds objectives as a member of phase one, to ensure that cloud service measurement was prominent in the report were achieved. However, the continuation of CSC was considered a valuable initiative that needed to be observed and commented on as part of the standardization activities in MODAClouds.

Phase one of CSC completed in December 2014 and phase two started in February 2015 Phase two is due to complete in 2015 with a review of four reports that were produced during phase two[1]. This October review will complete phase two with an edited and reviewed set of reports. Phase two consists of four work items with an emphasis on User Requirements. The four work items, supported by the relevant reports are: Understanding User Needs; Standards and Open Source; Interoperability, Conformance: The case for security and Cloud Computing Standards: Snapshot 2. It should be noted when reviewing the reports that there is a lot of overlap, for example three of the reports have a recommendation for increased marketing and dissemination. The review meeting mentioned above should address this overlap with a more general view of the needs for marketing and dissemination. All the reports have a section on improving the report. The work of CSC Phase 2 has been presented at the 8th NIST Cloud Computing Workshop in Gaithersburg on July 9th 2015.

The reports of the individual work items are discussed below.

3.1 Understanding User Needs[2]

The user survey and the work item Understanding User Needs have indicated that running a web survey on Cloud Standards may only have a limited number of respondents but that it has some relevant findings non the less. The principle areas of concern that are indicated are migration, security, legal compliance, mobility and SLA conformance and these have generated some recommendations. The first recommendation is to foster more collaboration across cloud computing stakeholders by encouraging collaboration across initiatives as well as between standards development organizations like ETSI and ISO. Collaboration with NIST is also one of the recommendations.

Dissemination and marketing will enable the customers, users and providers of cloud services to be aware of the existing standards and certification programs. The report also remarks that the low response to the web survey demands further avocation of marketing through the appropriate EU agencies and also by the standard development organizations. Allied to this recommendation there is also a suggestion that the Cloud web survey should be conducted regularly to identify gaps and gauge progress.

3.2 Standards and Open Source[3]

The report notes that standards and open source have different goals but that they are complementary. ITC projects frequently combine the two approaches but standards are the only way of stability and technological neutrality reducing vendor lock in. The report recommends that open source can support standards by:

- Helping overcome limitations in the development and implementation of Standards
- Speed the development and improve the quality of Standards
- Facilitate the understanding of standards for implementers
- Improve the Standard interoperability by using Open Source reference test-bed implementation and testing software.

There are a number of recommendations, however collaboration is the main suggestion and all the other recommendations in this report depend on the level of collaboration. For example, encouraging open source initiatives to standardize their specifications will require a high degree of collaboration between standards development organizations and open source organizations. Other recommendations cover organization and marketing, dissemination and promotion.

[1] Cloud Standards Coordination web page: http://csc.etsi.org/phase2/survey.html, accessed Sept 14th 2015
[2] User needs report: http://csc.etsi.org/phase2/UserNeeds.html accessed Sept 14th 2015
[3] Standards and open source report: http://csc.etsi.org/phase2/OpenSource.html, accessed Sept 14th 2015

3.3 Interoperability, Conformance: The case for security[4]

The report on interoperability and security notes several points that have the potential for slowing the adoption of cloud computing, outstanding gaps and the common theme, awareness, dissemination and marketing. The specific security based comment focusses on the risks that the complexity and lack of mapping cloud computing to standards will discourage further adoption.

Recommendations in this report again identify the need to accelerate the development of new standards to address the concerns about the gaps in standard provisions, and map the already existing standards to cloud computing. This recommendation is also related to certifications with the goal of increasing the uptake of cloud computing.

The report makes a valid point about the relevance and potential of the upcoming framework from ISO/IEC for Cloud SLA being important for the uptake of cloud computing. Use of existing standards for cloud computing terminology and the roles in cloud computing in the reference architectures will simplify the creation of Cloud SLAs that can address the core concepts in the report.

3.4 Cloud Computing Standards: Snapshot 2[5]

The standards landscape from the conclusion of phase one has improved and some of the ongoing work into Cloud SLA, interoperability and portability are considered as addressing some of the major concerns of users and the cloud community.

This report echoes the other reports with an emphasis on alignment, mapping, marketing and collaboration. It does note that there is a need to ensure that no fragmentation is created and that overlap and parallelism is avoided. All the recommendations are identical in essence to the recommendations of the other reports, although there is an emphasis on regular organized progress reports to advertise the progress being made. Overall the report is encouraging in noting that progress has been made in the two years since the CSC Phase one initiative started.

4 OASIS TOSCA: Current and Future work

4.1 TOSCA activity and its relation to CloudML

The TOSCA Technical Committee has enriched the definitions categorically in 2015. The current version of TOSCA standards that has been finalized by the technical committee and is put under public review is the simple profile in YAML v1.0. The extensions to the initial idea of the xml models include multiple arenas. Departing from the very first draft, there is a broader range of additional components and features, whose templates (including from features and requirements) have been well defined, for components like Compute, Storage, Network, Web Servers and Databases. Furthermore, the new paradigm of evolution of TOSCA has ensured technological agnostic development to assist support of container technologies, such as Docker and Rocket, as well as container management technologies such as Kubernetes, Mesos, and LXD. In addition, TOSCA is working towards declarative modeling of components that would in turn enable the specification of the metrics required to be collected for model definitions. This ensures ability of TOSCA to absorb specifications of monitoring specifics in the templates.

SINTEF has been following up the OASIS TOSCA standardization in particular to push our instance modelling and run time support of CloudML for standardization.

TOSCA supports the specification of types and templates (for this part CloudML is already aligned with TOSCA), but not deployment model instances necessary to support the run time. In contrast, CloudML supports the specification of types, templates, and instances. Therefore, in its current form, TOSCA can only be used at design-time, while CloudML can be used at both design-time and run-time.

SINTEF has recently presented the CloudML models@run-time approach to the TOSCA technical committee (TC) and proposed to form a " TOSCA ad hoc group" to examine how TOSCA could be extended to support instance modelling and runtime aspects. The TOSCA Technical Committee welcomed this proposal and, on 3 September 2015, approved by unanimous consent the formation of the TOSCA Instance Model Ad Hoc group to be co-led by SINTEF and GigaSpaces. The work in this group will take place during the coming months, starting in October 2015.

Finally, POLIMI participated to the monitoring ad hoc group remote meetings in its very beginning and provided initial input. MODAClouds monitoring platform Tower 4Clouds is conceptually compliant with the

[4] Interoperability, conformance report: http://csc.etsi.org/phase2/InteropSecurity.html, accessed Sept 14th 2015

[5] Cloud computing standards: snapshot 2: http://csc.etsi.org/phase2/Snapshot2..html, accessed Sept 14th 2015

TOSCA work and POLIMI will continue to consider the advancements of the ad hoc monitoring group in the next years within the context of the DICE and EUBRa-BIGSEA H2020 projects.

4.2 Potential impact and future plans

CA, SINTEF and POLIMI have indicated their future plans are to be active partners in the TOSCA Technical Committee, including participating in the regular conference calls and meetings. The aim is then to both contribute towards the next releases of the TOSCA standard based on development of the MODAClouds CloudML and then also to align the MODAClouds CloudML with the OASIS TOSCA standard.

5 Conclusion

This deliverable reports on standardisation activities performed by MODAClouds and current status from the first report at month 18 to the end of the project at month 36. The standardization landscape has changed considerably in the 3-year duration of the project. It is interesting to note the frequent claims that it takes a long time for standards to mature into a recommendation, but the potential changes in the cloud computing standardisation landscape over the three years have been dramatic. In the first deliverable, D10.2.1, a scan of the standards relevant to cloud computing was discussed, aided by the initial work in the Cloud Standards Coordination led by ETSI. This deliverable highlights the increasing focus of the standardisation efforts into the TOSCA initiative. The work in TOSCA has developed to such a stage that it will continue beyond the end of the project. CloudML will continue to develop during this time and will form part of the work of TOSCA going forward.

Little has been said of the NIST cloud service measurement working group, however this working group will add value for the multi-cloud service matchmaking domain. NIST cloud service measurement is directed to the development of a reference model and architecture, while the work in MODAClouds deals with specific measures. NIST cloud service measurement and the work in MODAClouds in service matchmaking will be a feature of the newly started MUSA project and live on from there.

The Cloud Standards Coordination has also been of interest and future work in this area will continue past the end of the project, although in the capacity of observer.

In conclusion, MODAClouds has made a significant contribution to standardisation efforts, in particular TOSCA and the influence of MODAClouds in the world of cloud computing standards will continue after the project has ended.