EU Interoperable cloud services & solutions report

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This document gives an overview of the results emerging from the first Concertation meeting for the unit Software Services and Cloud computing. The document highlights the main outcomes of the event including an initial analysis of potential clustering themes and future collaborations. The document also examines the use of standards by Call 8 and Call 10 projects.

CloudWATCH is funded by the EC FP7 - DG Connect Software & Services, Cloud. Contract No. 610994

Executive Summary

Cloud computing is an important driver of change to boost productivity and efficiency in the economy. Not only has public administration seen up to 90% cost savings, cloud also has the potential to create 3.8 million cloud-related jobs[1].

In recent years, competitive calls have brought wide coverage of cloud computing related topics to the European research and innovation landscape. Funded initiatives focus on technologies specific to the networked, the distributed dimension of software applications and access to services and data. This includes long-term research and emphasis on enabling software developers in Europe to easily create interoperable services based on open standards. Another important goal is ensuring open source creates value in new strategic ways. Recent initiatives have also focussed on heterogeneous clouds and the Internet of Things (IoT), networking, reliability, agile software prototyping, big data and better quality of service of user experience.

This Concertation meeting took stock of the latest activities of all active projects that have received funding through Unit E2 (including projects funded under Calls 5, 8 & 10, CIP as well as EU-Japan representation), including selected success stories, present and discuss new ideas. The event focussed on the importance of clustering & convergence which will feed into future Concertation meetings. This will support and expand the clusters from the other units within the Work Programme to ensure European leadership and provide a European market landscape of products, services and applications. Thereby achieving the "Platformed Thinking" approach that Europe needs to adopt, covering the complete value-chain of the ecosystem to encompass: networks and computing infrastructure, the platforms and services and the new developments for user community building.

The dynamic and interactive event featured break-out sessions, lightning talks and flash presentations serving as a springboard for discussions on cross-cutting themes and challenges not yet addressed. The sharing of best practices on standards, interoperability and portability were complemented by external insights as part of the drive towards an interoperable and trusted ecosystem of services in Europe. The event saw excellent contributions from projects with 92 participants from 47 projects. Furthermore, eight projects showed demos at the event. The event also saw the co-location of the CloudWATCH Standards Profile workshop and Use Case workshop, which are outside the scope of the present report and will be reported as part of the WP2 & WP4 activities.

[1] Ken Ducatel, DG Connect speaking at Unit E2 Concertation meeting 12 March 2014

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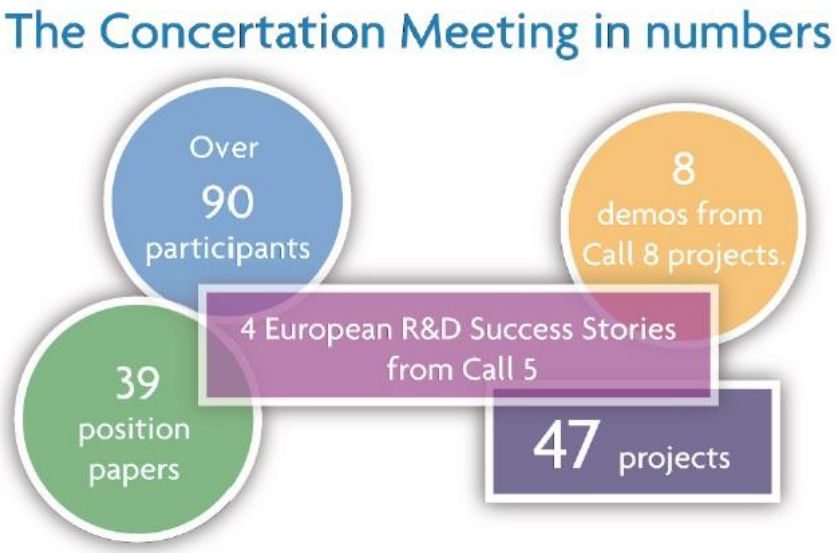

Figure 1 Concertation meeting in numbers

39 Position papers from participating projects	http://www.cloudwatchhub.eu/Position%20paper_Concertation-Meeting_March-2014.pdf
All presentations from the event	http://www.cloudwatchhub.eu/concertation_meeting_agenda
Overview of all participating projects	http://www.cloudwatchhub.eu/Projects
Overview of demos shown at event	http://www.cloudwatchhub.eu/demos

Table 1 Documents and related website contents

Disclaimer

CloudWATCH (A European Cloud Observatory supporting cloud policies, standard profiles and services) is funded by the European Commission's Unit on Software and Services, Cloud Computing within DG Connect under the 7th Framework Programme.

The information, views and tips set out in this publication are those of the CloudWATCH Consortium and its pool of international experts and cannot be considered to reflect the views of the European Commission.

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1 Leveraging existing technologies and knowledge

The European Commission has invested heavily in the development of software services and cloud computing. It is important that these efforts are consolidated and that full use is made by existing and future projects of the instruments that have been developed by building on software and knowledge already built.

Through the Concertation meeting CloudWATCH encouraged clustering activities and convergence between sector specific R&D initiatives. Bringing together the different projects from within and across EC funding calls and pushing for strategic alignment of the technical aspects of the projects can only bring benefits to the projects themselves and future activities that will be able reuse the outputs at a technical level. Already certain common themes are emerging between Call 8 and Call 10 projects and initial clustering of themes emerged from the Concertation meeting. Two examples are given focussing on unifying open source services, and scalability.

1.1.1 Unifying Open Source services and managing complex cloud environments

EC R&D projects are providing Open Source products and results. However, this is taking place in a disparate manner with clustering of efforts and reuse in the future for commercial exploitation in the EU ecosystem not currently managed well enough[2]. There is a growing need for more transparency about how the cloud is operating and information on Open Source Software adoption, such as models which aid transparency of performance of cloud: pricing, costs, IT resource management and use. Technological tools that help manage complex cloud environments are very important and CloudWATCH has identified a cluster of projects (CACTOS, MIDAS, MODAClouds, MONDO, OSSMETER, PROSE, RISCOSS) addressing this topic with the following areas for potential collaboration.

Provision of a Software "Repository" and "Collaboration" Space for open source software. PROSE already provides such a service.	**Assessment and Selection of appropriate Licensing and Business Models** addressing issues such as compatibility, choosing the right license, effect on business models.
Assessment Software Quality & Assessment of Service Implementations. Due to the complex and distributed nature, testing is difficult to carry out.	**Addressing platform, application and service behaviour variety.** Services behave differently on different platforms/hardware. Testing and analysis is required.

Table 2 Coordination requirements for unifying Open Source services

Future cluster work could focus on unifying, connecting or providing a workflow between various platforms creating an ecosystem of open source services such as software repository (PROSE), Risk analysis support for using open source software (RISCOSS), service testing framework (MIDAS), Quality assessment (U-QASAR). Furthermore, through cross-unit collaboration there is also a need to build on

[2] Ken Ducatel, Head of Unit Software & Services & Cloud Computing E2 DG Connect speaking at Future Internet Assembly March 2014

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existing software and services, encompassing test-bed facilities such as BonFIRE that validate new products and services and are already available under the remit of Unit E4 Experimental Platforms.

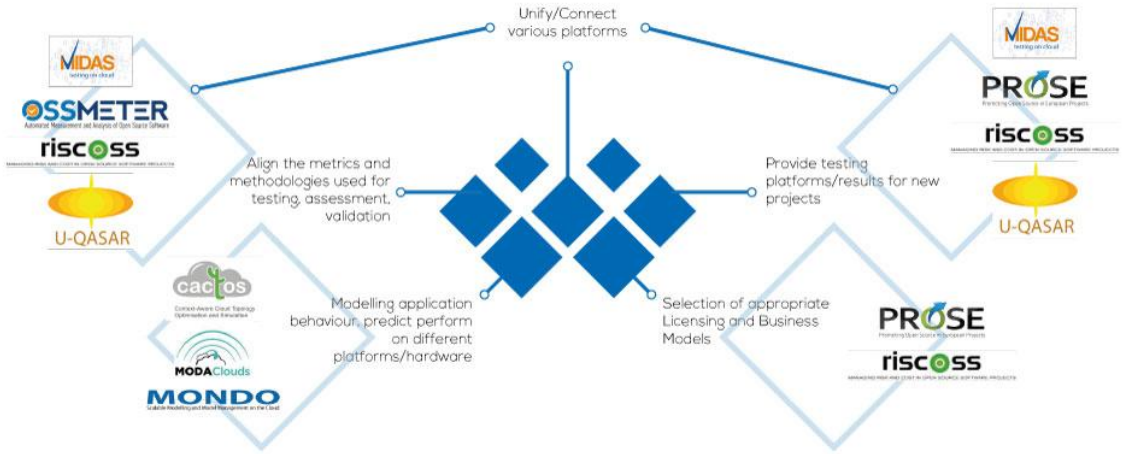

Figure 2 Unifying Open Source services and managing complex cloud environments

Each project delivers an important piece of a larger picture that could be unified into one single place or into a single workflow so that new projects can benefit

1.1.2 Scalability

Cloud provides a highly scalable platform for applications and device management systems that are either conventional software applications or cloud native applications. The following projects focus on aspects of scalability and may benefit from closer collaboration. The following projects address the issue of scalability and potential collaboration between these projects could take place as outlined in the figure below.

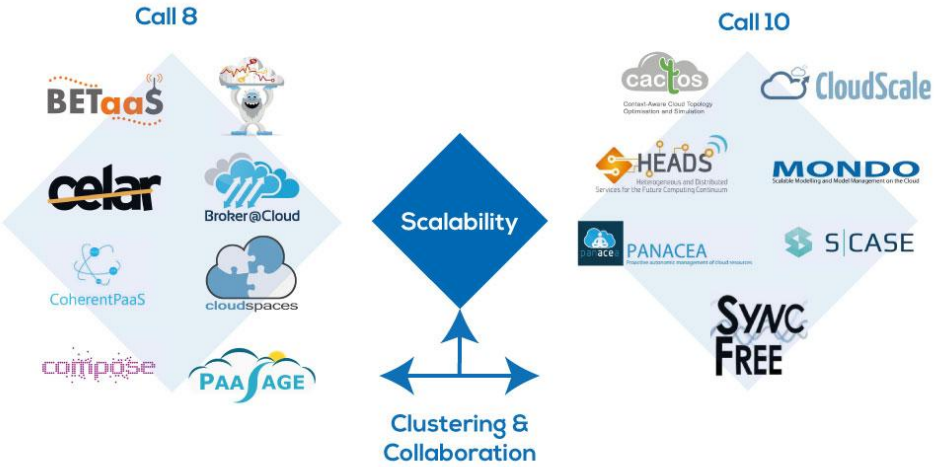

Figure 3 Scalability clustering between Call 8 & 10 projects

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1.2 Encouraging clustering - Breakout sessions & collaborations

Three break-out sessions were organised at the event focussing on three themes:

Cloud computing: BigFoot, CloudSpaces, CELAR, HARNESS, LEADS, OCEAN, OPENi, PaaSage, Ascetic, CloudCatalyst, Cloud4Europe, Clouding SMEs, CoherentPaaS and ClouT

Internet of Services & heterogeneous clouds: ARTIST, BETaaS, Broker@Cloud, COMPOSE, CloudScale, SUCRE, FELIX, HEADS, Panacea, SeaClouds, SyncFree, HTML5 and SOCIETIES.

Advanced Software Engineering: Open Source of Software Prototyping: MIDAS, MODACLOUDS, OSSMETER, PROSE, RISCOSS, U-QASAR, CACTOS, Mondo, S-Case and ORBIT.

Cloud Computing	Internet of Services & heterogeneous clouds	Advanced Software Engineering, Open Source of Software Prototyping
Organise focussed thematic workshops with projects presenting different work focussing on specific topics. Ocean plan to organise workshops **Collaboration with EGI** technical working groups Results of cloud computing research should be applied to set new goals for **addressing societal challenges** **Common dissemination materials and opportunities** for cloud computing projects. The CLOSER event will look at projects working on multi-clouds. **Need for user involvement** in future actions.	Comparative platforms for service provider offerings based on user requirements State-of-the-art European providers State-of-the-art European experimental facilities Users can trust their data & computing to the cloud (like they trust their money to the bank): Greater trust in the cloud so that users trust the cloud as they would the bank. My cloud works with your cloud "transparently" 1+2: We have to live with the fact that there are many clouds and this should be	**Align the metrics and methodologies used for testing, assessment, validation** (MIDAS/U-QASAR/OSSMETER /RISCOSS) 4 projects look into this and alignment is needed. **Modelling application behaviour:** understand how they will perform on different platforms/hardware (MONDO/CACTOS/ MODAClouds) - How to predict performance, behaviour and establish some models on application behaviour in different environments **New projects as potential test users of platforms/results** e.g. for open source platforms/licensing & risk assessment platforms (Prose/RISCOSS/MIDAS/U-QASAR) Use platforms to test software and give platform projects feedback on their platforms **Unify/Connect various platforms** projects deliver pieces: software repository from PROSE, Risk analysis support for using open source software - RISCOSS, service testing framework - MIDAS, Quality assessment - U-QASAR. How can we make a structure that the results from these projects into a service so new projects really benefit from this. There is dedicated budget in this

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		field.

1.2.1 Future collaboration

The Concertation meeting also provided the opportunity for future collaboration between projects. The table below identifies projects that identified potential synergies between projects.

Project	Potential synergies with
ARTIST	MODAClouds, Paasage, CIP Projects
CACTOS	CloudSpaces(use of Palladio), MODAClouds (use of Palladio), MONDO (how their goals aroun application models fit in with CACTOS), ORBIT (methods to achieve robustness), PANACEA (to discuss autonomic management
CELAR	U-QASAR (to integrate our tools to improve their runtime guarantees)
CLIPS	CIP Projects
CloudWATCH	MIDAS, PROSE
ECIM	HTML5Apps (for end-user apps), PROSE (as an infrastructure), RISCOSS (data analysis)
HEADS	BETAAS, COMPOSE, SyncFree, Bonfire (via ECO2 Clouds), Flexiant
OPENi	ASCETIC, PROSE (to support the development of service enablers and APIs), STRATEGIC (to support their data analysis for H2020 societal challenges), STORMCLOUDS (to support their data analysis for H2020 societal challenges), CIP Projects (in general to see how they can be supported)
ORBIT	CACTOS (investigate heterogeneity of various platforms), RISCOSS (analyse risk and cost assement), U-QASAR (analyse software quality)
PaaSage	CLOUDSCALE (to extend the expert system), CIP Projects
PROSE	RISCOSS
RISCOSS	PROSE
SeaClouds	MODAClouds
SOCIETIES	PROSE
STRATEGIC	CLIPS, CloudOpting
U-QASAR	MIDAS, ORBIT, OSSMETER, RISCOSS

Table 3 Potential synergies between projects

The mutually suggested collaborations were:

- CACTOS & ORBIT
- ORBIT & U-QASAR
- PROSE & RISCOSS

1.2.2 Shared Requirements

The table below groups together both the shared needs of projects more general needs identified for the European marketplace and finally needs which are specific to individual projects. Finally, future ideas are also identified by each project for focus of future work. Further analysis of this information will help support potential collaboration through a need -driven exercise.

Requirements shared by projects

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Support for raising awareness, target audience outreach and uptake -Approaches and guidelines to encourage use of the cloud by public authorities (CLIPS) -**Synergies** between the **CIP** project (CLIPS) -**Access to stakeholder interest in smart cities** (COMPOSE). This could help drive possible convergence across units, e.g. FI-PPP and FIRE. -**Support for project dissemination** and collaborations (MODACLOUDS) **-A book** about the status of on-going EC-funded projects in cloud computing (MODACLOUDS) -**Requirements, criteria and indicators** of how the transition to the cloud is made (Storm Clouds) -**Showcase of smart cities** (Storm Clouds) -**Repository of project needs/offerings** to boost collaboration (U-QASAR)	**Try and test" approach** -Test solutions with CIP projects (ARTIST) -Foster informal collaborations between projects (CloudCatalyst) -**Monitoring and testing of services** (ECIM) -**Other projects testing and enriching** the platform and methodology (PaaSage) -Technology, infrastructures and platforms for **building and testing our tools** (SyncFre **Open source repositories** -**Repository for open source software** (ASCETIC) -**Best practice exchange** of open source licensing models (Broker@Cloud) -**Data sources and statistics** related to code quality, OSS community behaviour and OSS business models (RISCOSS)
General needs for the European marketplace	**Needs specific to individual projects**
-**Technical solutions** provided by EC-funded projects (CloudCatalyst) -An understanding of how **technical barriers** are being addressed (CloudCatalyst) **-Best practices** related to government, healthcare, ICT, education and others (CloudCatalyst). -**User requirements** to define standards profiles (CloudWATCH). This links to the acknowledgement of the importance of privacy and interoperability, e.g. OPENi. -**Benchmarking of cloud providers** and services (ARTIST) -Related need for **pricing strategies** (Broker@Cloud) -Templates for SLAs (Broker@Clouds)	-**Open source IDE and runtime environment** for the high level design of applications (ASCETIC) -**Application modelling tools** (CELAR) -**Scalable orchestration engine** (COMPOSE) -**Infrastructure for hosting** (ECIM) -**Guidelines for integration** (ECIM) -**Development guidelines** (ECIM) -**Cloud migration** (FELIX) -**Data management** (FELIX) -**Prioritisation of new HTML5 features** to fill the gap with native OS AOIs (HTMLAPPS5) -Ideas for **future R&D web apps** (HTMLAPPS5) -**Ultra large model management** (MIDAS) -Effective **elasticity** (MIDAS) -**More application and infrastructure** related information (PaaSage)
Future ideas	
Project value and uptake -Integrate **LEAN development** to prove the value of the project to cloud users (CloudCatalyst) -**Clustering of projects** across the programme on themes for collaboration to maximise results (CloudWATCH) -Organise **exploitation-focused workshops** (PaaSage) -Gather information/contacts on **public clouds used by public administrations** (Sucre) -Investigate other **project offers** to understand how to be more competitive with Amazon (SyncFree)	**Non-technical issues and standards** -**Direct contact** with projects involved with **standards** (HTML5APPS) -**Discussion with unit staff** on coordination of standards goals (HTML5APPS) -**Investigate the issue of transparency** in cloud-based systems (Storm Clouds) **Cloud technology advances** -**Ultra-large model management** (MIDAS) -Effective **elasticity** (MIDAS) **SaaS** -**Software engineering for SaaS** looking at elasticity, efficiency and scalability (ARTIST)

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-**Extend tools** to work with the applications from other projects (SyncFree) -Form a consortium to implement the services developed by the project (VIRGO)	-**Interactive applications** in the cloud, their functional and non-functional requirements and implications on current cloud solutions/architecture (ARTIST)

Table 4 Projects' shared needs, general needs for the European marketplace and specific needs

2 Contributing to the Standards Landscape

The collection of position papers from the Concertation gives an overview of standards adoption both actual and planned by Call 8 and 10 projects. Information also included project contributions to standards development including engagement with Standards Development Organisations. A snapshot of this information can be seen from the table below which shows some of the most used standards: OGF-OCCI, OASIS-TOSCA, SNIA-CDMI and DMTF-OVF. Other standards are also used by projects but are not cited here.

Standard	Usage in Call 8 & 10 projects
OCCI - Open Cloud Computing Interface (OGF)	Call 8: BETaaS, OCEAN (Interoperability testing) RISCOSS (Risk Analysis) Call 10: ASCETiC, CloudWave, ENVISAGE, ORBIT, PANACEA
CDMI - Cloud Data Management Interface (SNIA)	Call 8: OCEAN (Interoperability testing), RISCOSS (Risk Analysis) Call 10: ASCETiC, ClouT
OVF - Open Virtualization Format (DMTF)	Call 8: OCEAN (Interoperability testing), RISCOSS (Risk Analysis) Call 10: ENVISAGE, ORBIT, PANACEA
TOSCA - Topology and Orchestration Specification for Cloud Applications (OASIS)	Call 8: ARTIST, CELAR, MODAClouds, Call 10: SeaClouds

Table 5 Most used standards by Call 8 & 10 projects

Furthermore, projects are addressing issues requiring further focus above and beyond the current iteration of ETSI Cloud Standards Coordination report. It is clear that though the focus of these activities has been on the management interfaces that there are a number of different services that need to utilize standardized interfaces, for example accounting, monitoring and service description.

Open Source projects are now contributing to the cloud standards landscape by creating interoperable, portable and safe APIs, protocols and environments that are tried and tested. Therefore, CloudWATCH2 will engage with projects using OpenSource solutions in order to monitor uptake and usage. Open Source is a tool for developers & identification of new strategically game-changing forms of organisations and innovative business models should be identified.

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3 Conclusion and next steps

One of the main findings of the Concertation Meeting is that the projects all have similar concerns and views on the current and potential future state of cloud computing in Europe. These include portability, security and the ability to advance cloud technologies in a highly competitive marketplace. Underlying these shared concerns however is the common belief in the need for standards, transparency and assessment of services at all levels of a cloud infrastructure.

Participating projects cover the entire life cycle of cloud research, from development and testing to implementation, dissemination and sustainability. Closer collaboration and networking across all these projects is important for several reasons. Firstly, projects can identify providers for their applications etc., they can adopt a "test and try" approach to validate re-usability and value; build on results already available, further work on standards and move to implementation more quickly.

One of the main values of the meeting was the opportunity to quickly identify various collaborations, which can be clustered around specific themes, such as elasticity, portability and transparency. Potential synergies include:

- Selecting licensing and business models - PROSE and RISCOSS
- Testing, assessment and validation of applications – MIDAS, U-QASAR, OSSMETER and RISCOSS
- Modelling application behaviours – MONDO, CACTOS and MODAClouds
- Testing results of projects – PROSE, RISCOSS, MIDAS, U-QASAR

The projects that both identified each other as potential collaborators were:

- CACTOS & ORBIT
- ORBIT & U-QASAR
- PROSE & RISCOSS

The successful format of the event has helped transform the way Concertation Meetings are organised with opportunities for each participant to actively contribute through lightning talks, discussions, polarised break-out sessions, position papers and feedback forms. The aim of the next Concertation Meeting in September 2014 is to offer a platform to take forward and build on current achievements. Its format, focus and the work of CloudWATCH in coming months will take on board the following recommendations, which come directly from the projects through a collaborative process.

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Recommendations from Concertation Meeting 12-13 March 2014	
Recommendations	**CloudWATCH Actions**
Clustering of like-minded projects together in smaller groups. Cross- project collaboration & showcasing on common topics	Initial mapping of technologies emerging from and potential clustering of projects for second Concertation meeting.
Direct f2f with other projects & unit staff on standard coordination goals has been key	Future Concertation meetings to provide a platform for project representatives and EC to gather together and take stock of progress and reassess goals in evolving landscape.
Share needs/offerings of all ongoing projects to boost collaboration amongst projects	The EU R&D Innovation Hub on CloudWATCHhub.eu provides a snapshot of European excellence to a broad audience for potential uptake. Pragmatic follow-up charged with showcasing projects progress.
Organise Shared exploitation focused workshops and activities	CloudWATCH has already provided exploitation opportunities for over 20 projects through a targeted networking session and exhibition stand during ICT2013[3]. CloudWATCH will build on synergies with unit projects.
Data & Statistics from other projects to be used to foster informal collaboration between projects and units to enable testing of results. A "Test & try Approach" so EU Projects feel less isolated. Other projects (including CIP) to test & enrich those Call 8 & 10 project "platforms"	Clustering activities will encourage the re-use of existing software and services. CloudWATCH has identified clustering and actions to connect or creating a workflow between Open Source services including risk analysis and service testing framework (D3.2) Foundations for collaboration with recently funded (early 2014) CIP projects also established for testing. A number of Call 8 and 10 projects have earmarked collaboration with CIP projects.

[3] http://www.cloudwatchhub.eu/node/75

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