

## D3.1 Structure and aspired outcomes of Cloud Interoperability Plugfests

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This deliverable provides a brief review of the current cloud interoperability plugfest setup. Located in the area of expertise in the cloud ecosystem, it will assess the current setup against the cloud characteristics developed by NIST. Finally, the document proposes a new and innovative way of delivering cloud interoperability plugfests.

## CloudWATCH Mission

CloudWATCH2 takes a pragmatic approach to market uptake and sustainable competitiveness for wider uptake and commercial exploitation. It provides a set of services to help European R&I initiatives capture the value proposition and business case as key to boosting the European economy.

### CloudWATCH2 services include:

- ❖ A cloud market structure roadmap with transparent pricing to enable R&I projects to chart exploitation paths in ways they had not previously considered, or help them avoid approaches that would not have been successful.
- ❖ Mapping the EU cloud ecosystem of products, services and solutions emerging from EU R&I projects. Identifying software champions and best practices in mitigating risks associated with open source projects, and ultimately, enable faster time-to-value and commercialisation.
- ❖ Impact meetings for clustering and convergence on common themes and challenges. Re-use of technologies will also be of paramount importance.
- ❖ Promoting trusted & secure services through roadshows and deep dive training sessions. Giving R&I initiatives a route to users at major conferences or in local ICT clusters.
- ❖ A portfolio of standards for interoperability and security that can facilitate the realisation of an ecosystem of interoperable services for Europe.
- ❖ Cloud interoperability testing in an international developer-oriented and hands-on environment. Findings will be transferred into guidance documents and standards.
- ❖ Risk management and legal guides to the cloud for private and public organisations to lower barriers and ensure a trusted European cloud market.

### Disclaimer

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The information, views and tips set out in this publication are those of the CloudWATCH2 Consortium and its pool of international experts and cannot be considered to reflect the views of the European Commission.

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## Executive Summary

CloudWATCH2 will deliver three Cloud Interoperability Plugfests during its lifetime. These are events, where technology providers can mutually test their implementations of standardised specifications for conformance and interoperability, sometimes under closed conditions supported by NDAs on results. The most prevalent and longest-running series of interoperability testing events are conducted by the Cloud Plugfest initiative, since April 2011. These plugfests are co-operative community events hence participation and frequency can vary, from between three events in 2011, up to five events in 2014, and two events in 2015.

While plugfest events were designed as face-to-face events when they started, more recent activities have seen an emerging trend of less personal attendance towards a more virtual/online presence instead, which we attribute to three prevalent factors during the past five years of plugfests: (i) Tightened travel budgets, (ii) tighter development schedules, and (iii) mainstream adoption of specifications.

Addressing these issues is important to sustain a long lasting effort in improving conformance and interoperability across implementations of any given standardised specification, and the Cloud Plugfest Initiative plays a vital role in this area, ensuring contingency of plugfests during the lifetime of the project itself, and suggesting a novel model for plugfests as one of its concrete results.

Before introducing change into an existing system to address an issue at hand, one needs to know what to change and which impact it will have on the system and its connections. To do so, section 1 (re-)introduces the concept of plugfests (which is no different for cloud technology than any other software or even hardware technology) as such, and restates the objectives and goals of each of these sessions, and in the long-run across all events.

Determining conformance and interoperability (and, where needed, compliance) in the cloud computing landscape, we believe it important to consider applying the cloud computing paradigm, particularly the NIST cloud computing characteristics to the plugfests themselves, even though these mostly describe operational cloud services (without explicitly saying so). Hence section 2 confirms the positioning of plugfests as primarily testing events in the software development lifecycle, conducting blackbox conformance/compliance testing at the subsystem interface level.

Preparing for making the right choices for a new and improved model of how to conduct plugfests, we briefly analyse the current value proposition of cloud plugfests in section 3, and indicate where they should change towards a more cloud-inspired way.

Forming the core of this deliverable, section 4 proposes how the EC CloudWATCH2 project intends to conduct future plugfests. Being a cloud related project we see no reason not to turn cloud plugfests into a cloud event as much as possible, so that they would express cloud characteristics in a way analysed in section 2: Considering plugfests as a service to any stakeholder in the standards community means that they plugfests could be conducted at scale both in frequency and participation.

Section 5 takes the findings and requirements of previous sections, and describes a high-level composition of a cloud plugfest infrastructure for the CloudWATCH2 project to pursue over the course of its duration. Aiming for future plugfests with either predominantly or exclusively remote participation, choosing a public cloud service provider to underpin plugfest activities (and, later-on, services) requires a careful composition of available service components. Since cloud plugfests also include commercial participation, diligence must be applied to data privacy and confidentiality policies of the candidate service providers. Section 5.2 provides an analysis and a solution for the selected provider, in this instance Google Inc.

Although an option for the future conducting plugfests as a sustained service, supported by a business model, business plan, and established revenue streams, is currently not considered as this would require effort beyond the remit and capabilities of the CloudWatch 2 project. Instead, we aim at changing the support infrastructure into something that comes close to a service that CloudWATCH2 itself can then efficiently invoke for its plugfests duties. At the same time the plugfest events will serve as validation of the feasibility of the chosen approach, supporting both physical and remote presence of participants. Beyond the CloudWATCH2 project, stakeholders may decide to take on the direct and indirect results of CloudWATCH2 plugfests and:

- a) Improve/commercialise the plugfest infrastructure into a full-blown service,
- b) Provide plugfest events as a service (if there is a market for this),
- c) Use some of the assets as showcases and training targets for IT education courses and certifications.

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# 1 Introduction

Cloud interoperability plugfests are events, where technology providers can mutually test their implementations of standardised specifications for conformance and interoperability in an arena where the test results are private, allowing the testing of upcoming or pre-production products/services.

The most prevalent and longest-running series of interoperability testing events for cloud-related technology has been conducted and hosted by the Cloud Plugfest initiative<sup>1</sup> (CPI) since April 2011. These plugfests are co-operative community events and hence participation and frequency can vary, from between three events in 2011, up to five events in 2014, and two events in 2015. Some plugfests were very well attended with over 50 participants, while others were rather small and intimate events, with 10 highly participating developers.

While plugfest events were face-to-face events in the beginning, more recent activities have seen an emerging trend of less personal attendance and more virtual/online presence instead. While we are aware of several factors that may contribute to this trend, we conjecture that the most prevalent factors are:

- Tightened travel budgets as part of the aftermath of the 2008 financial crisis still prevalent particularly in Europe,
- Tighter development schedules in the wake of DevOps and its impact on the software development lifecycle (SDLC), and
- Some of the standardised specifications of the early days have found their way into mainstream commercial products, though not necessarily advertised as that (c.f. CDML and OCCI adoption levels)

Notwithstanding this, conformance and interoperability testing is still a necessity as is demonstrated time and again with entire business models and commercial sectors operating on this premise, though often on different levels and objectives.

The community focussing on technical interoperability, particularly the cloud software landscape as is the focus of this report, needs to address the impact these identified factors have on its business. Even though these may not be disruptive, they are certainly exerting significant impact that we as a community must address. CloudWATCH2 supports such testing and will organise three such events combining both physical and remote participation, as outlined in this document.

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<sup>1</sup> <http://www.cloudplugfest.org/>



Figure 1 CloudWATCH2 Outputs

As figure 1 shows, cloud interoperability testing is part of CloudWATCH2's main outputs. Task 3.2 Interoperability plugfests & adoption gauges sees the organisation of 3 cloud interoperability plugfests. Results will feed into WP3 (Standards, specifications, risks and legal recommendations) activities in particular to map the use of standards by R&I projects (T3.1) and the evolution of the standards portfolio established in CloudWATCH<sup>2</sup>. This activity will also support projects in identifying common needs and appropriate interoperability standards. The cloud plugfests then provide the opportunity for projects and other stakeholders to actually test standards.

<sup>2</sup> <http://www.cloudwatchhub.eu/assessment-cloud-profile-interoperability-testing>



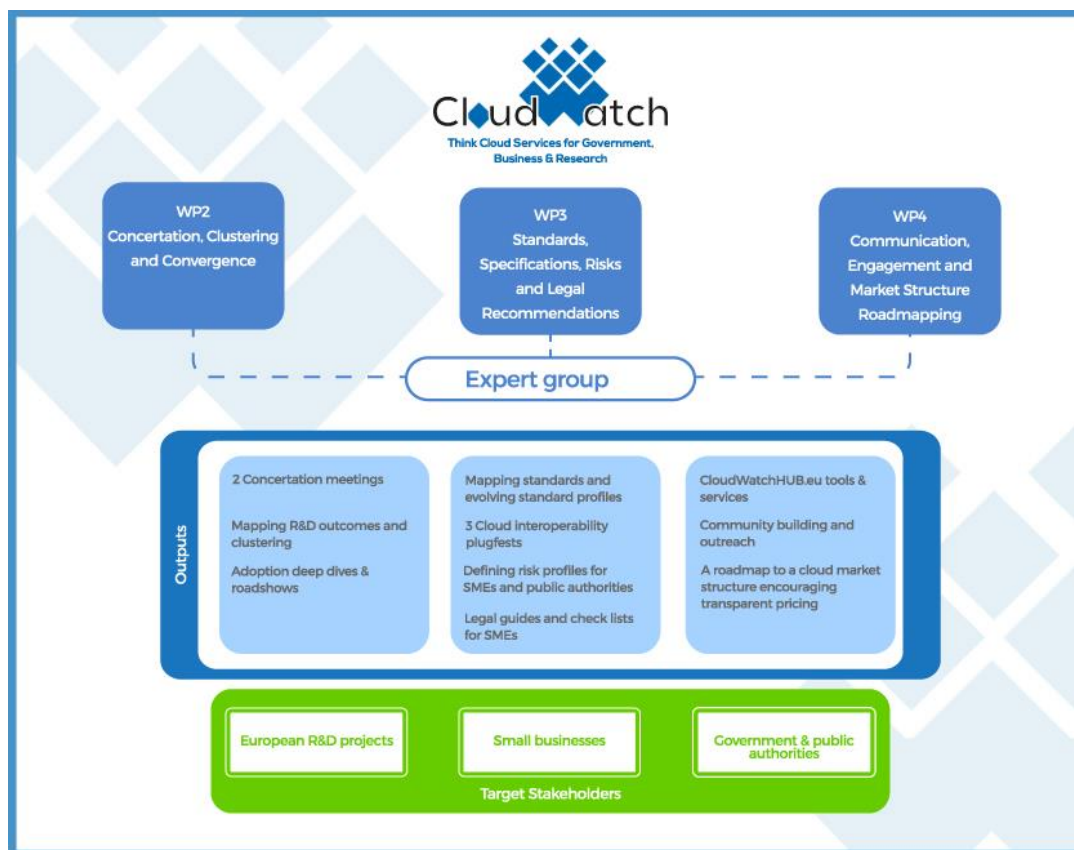


Figure 2 CloudWATCH2 at a glance

## 1.1 Plugfest objectives

By intentionally stepping back to the drawing board, we are able to confirm or amend the principal objectives of (cloud) plugfests:

- Assess conformance to a standardised specification across implementations
- Promote and facilitate interoperability of implementations or policies.
- Provide an “information bazaar” for implementers regarding hidden/unexpected implementation pitfalls
- Gather insights on the adoption level of a standard specification

### 1.1.1 Standards conformance of implementations

It is important for all stakeholders to gain unbiased and fair knowledge about standards conformance of a given implementation.

Procuring IT assets, irrespective of it being a service, software, product, or other nature, the procured asset must almost always conform to a number of standards (formally: standardised specifications) to be considered fit for integration into the existing IT infrastructure. Procurers may rely on external, third-party certification, particularly when compliance is required, but first-hand information and evidence is nonetheless desirable or even required.

IT service providers need to assure themselves that the services they offer indeed conform to an identified set of standards in order to respond to tenders, market their services, etc.

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Often overlooked, Technology Providers are the third stakeholder, particularly when acting as an independent entity in a supplier relationship with Service Providers. Although often a dependent organisational unit within Service Providers, Technology Providers are regularly the first and most involved partners in standardisation and, eventually conformance and interoperability of their implementations.

Conformance to standards primarily addresses formal technical aspects of standards, i.e. syntax, message exchange sequences, data and information models, timing, parallelism, state (or state-less) models, interface descriptions, conformance tags and many more. Often, conformance suffices to also enable interoperability, since particularly for less complex systems, it also sufficiently captures semantics of the data exchanges.

Conformance is almost always the first goal to address, after the decision to implement a standard has been taken (including understanding the goals and requirements of the chosen standard).

### 1.1.2 Facilitating interoperability

Though often conflated, conformance and interoperability are not the same. At the same time, any two independent implementations may conform to a specification, but they may not interoperate. Alternatively, they may interoperate but neither may conform to the specification. Between those two extremes any symmetric *and* asymmetric variation may occur.

Implementing standards is *always* subject to individual interpretation of the implementer – this is unavoidable and intrinsic in the entire process. To minimise the risk of (mis-)interpretation of the normative text in the specification document(s), standards developing organisations devote a great deal of time and effort into what is commonly called *word smithing*, i.e. wrangling for the most context-free, clearest, and the least misinterpretation-prone text in the published document(s).

Yet, next to deliberately built-in optional and alternative elements in a specification, the text in a specification will always be interpreted and understood in a different way than originally intended, even for the most profane reason of non-native speakers making sense of what's often written in English.

In any case, interoperability of two implementations that are *not* reference implementations confirms that at least two different groups of individuals have derived the same or sufficiently similar conclusions from a specification so that their machine implementations are able to engage in machine-to-machine (or at times human-to-machine) interactions in a purposeful and insightful manner.

Documented interoperability thus gives evidence to independent arrival at the same *semantic* understanding of the same specification.

### 1.1.3 Implementers' "information bazaar"

Often, standards development organisations ask implementers for their feedback on implemented standards, or more formally, for *experience reports*. While these are important to standards development organisations for all the right reasons, they are almost entirely unimportant to implementers and as a consequence, notoriously difficult to obtain.

It is unclear to us what the exact reasons are, but we conjecture that implementers might consider such reports "a waste of time", or "yet another document to write...". Information exchanged in written form can also be perceived as too formal and/or official. Implementers do though exchange information and prefer talk to each other, or chat.

Therefore, we consider regular meet-ups as vital to passing information around, transferring knowledge and instigating knowledge-formation in fellow implementers.

#### 1.1.4 Standards adoption levels

Last but not least, a valid way of measuring one's success, is for standards developing organisations to capture how widespread and adopted any of their published standard specifications are.

Conducting plugfests, in whichever shape or form, is a good opportunity to gather further insight in that direction.

## 2 How cloudy are plugfests currently, and just how cloudy can they be?

When talking about conformance and interoperability testing for cloud technology, it naturally gives rise to the question "Why not make it a cloud-based system?" – and rightfully so. To answer this question we need to briefly revisit the typical software testing methods used during plugfests.

### 2.1 Cloud plugfest software testing methods

#### 2.1.1 Testing methodologies

Typically, plugfests use the **black box testing** methodology, where any two implementations by different and independent development teams are tested. Although code may be altered and republished during plugfests, no access to the executing code irrespective of it being interpreted or compiled is presumed during testing and test plan development. However, at times when publicly available open-source reference implementations are used, **grey-box testing** is applied.

#### 2.1.2 Testing levels

Contemporary software testing and QA strategies typically include five levels of testing: Unit testing, *Integration testing*, *Subsystem testing*, *System/Functional testing*, and Operational Acceptance Testing. Even though all five are vital for any professional software quality assurance strategy, only the middle three testing levels are of relevance for the Cloud plugfest testing:

##### **Integration testing.**

Located at a level of granularity higher than Unit testing, integration tests ensure that application, service or infrastructure subsystems can be executed together, within defined constraints and conditions, similar to those of unit tests.

##### **Subsystem / component interface testing.**

"Sandwiched" between integration testing and system testing, component interface testing is frequently used in distributed application and infrastructure situations, or where subsystems sourced from different providers need to be integrated. While subsystem testing obviously overlaps with its direct siblings integration testing and system testing, it is often aligned with and focuses on interfaces exposed along distinct nodes identified in the application's deployment architecture.

##### **System / Functional testing.**

Functional testing focuses on ensuring end-to-end use cases and scenarios, on features that enable or allow accomplishing added-value generating functions of the application (hence the name), very frequently including end-user interaction. System testing, often if not always, crosses boundaries of deployment nodes in distributed system architectures.

Most obviously, subsystem interface testing is the prime level of testing for Cloud plugfests. However, it borrows important characteristics from both its siblings Integration testing, and system testing, in that it combines automated testing, manual testing, non-functional and also functional testing into one event. This is a situation that must be kept into account when proposing a structure for future plugfest events.

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### 2.1.3 Test types

A plethora of test types are available covering all sorts of use cases and aspired outputs. A good overview is provided by Wikipedia<sup>3</sup>. For plugfests, the almost exclusively employed test types are **conformance** and/or **compliance testing**.

Conformance testing, as the name says, ensures that an implementation formally conforms with all technical requirements of a standard specification. In fact, specifications, but mostly profiles on existing standards refer to “conformance targets” when describing specific normative circumstances. Conformance testing is often implemented as automated, integration-level blackbox testing.

Compliance testing is often employed when requirements are not sufficiently formalised for conformance testing, irrespective of it being a shortcoming of the standard development itself, or an intrinsic issue with the requirement at hand. This is often the case where the success of an operation depends on untestable and/or uncontrollable external context, or where user interaction and judgement is required. Compliance testing implies user interaction, or in the case of automated testing, final judgement of the user or judicator executing the tests.

## 2.2 Applying cloud characteristics to cloud plugfests

Surprisingly, testing conformance and interoperability for cloud specification implementations seem less “cloudified” than the actual application. The rise of Virtualisation hence also Infrastructure-as-a-Service and Container-based infrastructures are the very enabling technologies that allowed DevOps, Continuous Integration and Testing emerge as new paradigms in the software development sector. These are at the same time significant drivers and consumers of the cloud paradigm and thus are often if not always “cloudified”.

However, such systems are often scoped around one administrative domain, such as a company, or even a collaborative Open Source project – rarely, they also cover higher levels of software testing.

Consequently, in this section we have applied NIST’s definition of cloud computing, more precisely, the essential and common characteristics, to cloud standards conformance and interoperability testing. This gives us insight into shaping future plugfest infrastructure and methodologies. CloudWATCH Deliverable D2.4<sup>4</sup> provides the complete definition of all 13 NIST characteristics. In this section we describe the results of applying these characteristics to cloud plugfests.

### On-demand self-service

Being cloud interface testing, infrastructure for testing should literally be available on-demand, and in a self-serving manner. Where reference implementations are available, these should be made available as instances for semi-instantaneous execution. This is typically the case for reference implementations for service implementations that are contacted by consumer-side implementations.

However, the converse should be true as well, that available client implementations can be instantiated and configured to “talk back” to a server implementation that is under development.

Self-serving infrastructure is applicable for two main scenarios. Firstly, in a learning and implementation phase, a development team uses an existing reference implementation service for live interaction to learn and adjust their implementation accordingly.

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<sup>3</sup> [https://en.wikipedia.org/wiki/Software\\_testing#Testing\\_types](https://en.wikipedia.org/wiki/Software_testing#Testing_types)

<sup>4</sup> [www.cloudwatchhub.eu/sites/default/files/D2.4\\_Identifying-location-within-the-cloud-ecosystem\\_vFINAL\\_0.pdf](http://www.cloudwatchhub.eu/sites/default/files/D2.4_Identifying-location-within-the-cloud-ecosystem_vFINAL_0.pdf)

The second scenario allows for recording conformance test runs with recorded results, similar to unit and integration testing in ordinary environments. Subsequent test runs allow not only for the monitoring of the progress of an individual implementation, but also a quick and effective aggregation of standards uptake information. A real-life example for this type of service is “do you speak occi” implemented a few years ago, and available on the Google App Engine<sup>5</sup>.

On-demand self-service testing services would be ideal for automated conformance testing of implementations against available reference implementations.

### **Broad network access**

Existing cloud-specific standards are M2M (machine-to-machine) level specifications that are merely indirectly influenced or controlled through user interaction. M2M interfaces are by nature agnostic to the type and nature of the origin of data, for as long as all transmitted data conforms to its requirements.

### **Resource pooling**

Resource pooling is typically expressed in production environments only; applying resource pooling to cloud plugfest may only be expressed in a scenario where such testing infrastructure and services are continuously provided. In such cases, available resources would be pooled among all plugfest participants.

### **Rapid elasticity**

To a certain extent, cloud plugfest infrastructure *should* be elastic, however infinite elasticity is neither needed nor necessary since it typically depends on the available resources. This is easier accomplished with asynchronous and centralised plugfest resources – plugfests focussing on cross-implementation testing is usually resource limited by the laptops brought along by the developers running ad-hoc instances of the servers.

### **Measured service**

Normally defined as accurate and near-realtime aggregation of resource consumption of service users, this is clearly not a goal for cloud plugfests – not even in cases measurements and metrication would be the topic for conformance and interoperability testing. Accuracy and correctness of metrics generated by any given implementation remains the exclusive scope of that implementation.

However, interpreting “measured service” for the specific purpose of cloud plugfests (and for this purpose only), several measurements come to mind when conducting plugfests, among which are:

- Number of participating implementations
- Number of (and which) standards being tested
- Conformance ratio of individual implementations (0%, up to 100%)
- Number of pairwise interoperable implementations
- Standards uptake per sector

And many more. All this information is important for post-plugfest evaluation for all stakeholders.

### **Massive scale**

Massive scale is of no concern to cloud plugfests as it is not meant to be a production environment, nor is scalability of implementations a concern for conformance and interoperability testing.

### **Homogeneity**

Homogeneity does not play a role at cloud plugfests – homogeneity may be a characteristic expressed in operational environments where procurement at scale may lead to homogeneous infrastructures.

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<sup>5</sup> <https://www.openhub.net/p/dyso>

### **Virtualisation**

Virtualisation does indeed play an important role in cloud plugfests: The vast majority of participating developers expose their plugfest endpoints contained in laptop-based virtual servers, powered through e.g. VirtualBox, Linux KVM or other means.

Concerning the plugfest support infrastructure itself, virtualisation may be exploited for providing some of the supporting services on a long-term basis, where external services are not available or do not serve plugfest-specific needs.

### **Low-cost software**

Not an issue for cloud plugfests; provenance and business model of software are not relevant.

### **Resilient computing**

While resilience is an operational concern, resilient plugfest infrastructure not only facilitates a smooth and efficient event operation, but is also important for the message conveyed to the general public of appropriate professionalism of the staff. In fact, embracing cloud computing for cloud plugfests operations should also include paying attention to service resilience and reliability.

### **Geographic distribution**

Plugfest infrastructure does not need to be geographically distributed as it doesn't need to address disaster recovery, nor global service reliability and response times.

### **Service orientation**

Interpreting service orientation in a business model sense rather than technology and engineering sense, plugfests themselves, should be designed and operated with a strict service orientation methodology in mind. This includes the entire plugfest support infrastructure.

### **Advanced security**

Security precautions need to be put in place for plugfest events and activities (in whichever shape or form, see below). This gives the participants confidence that results will be private and available to authorised persons only. Inappropriate disclosure could have severe commercial consequences. We interpret advanced security as an amalgamation of several aspects, such as:

- Access control without centralised credential management
- Multi-level authorisation for plugfest support services
- Privacy of sensitive user information and a "personal data austerity" policy
- Multi-level data protection policy for collected results depending on tool usage scenarios
- Data processing policy for multi-level information aggregation towards event and infrastructure sponsors

## **3 Cloud plugfest value proposition revisited**

In this section, we will reiterate the value proposition of Cloud plugfests. We use the business model canvas and value proposition canvas model developed by the founders of, and sustained and commercialised by Strategyser Inc.<sup>6</sup>.

In a nutshell, the Cloud Plugfest initiative's business model is centred around providing a service for members/sponsors to physically plan and conduct plugfest events. It is by structure very similar to commercial franchising models sans contractual and legal obligations. Such a model facilitates scalability of

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<sup>6</sup> <http://www.businessmodelgeneration.com/canvas/vpc>



plugfest events both in event size as well as frequency, provided that the Cloud Plugfest brand conveys a message of professionalism, quality and impact for event organisers to join the franchise.

Nonetheless, this model revolves around organising events that imply, even require physical presence of the participants. As discussed in section 1 this model's success is hampered by a number of factors that need addressing. Following the value proposition model canvas approach, the plugfest event service customer's job or purpose is to:

1. Procure access to facilities such as meeting rooms, etc., i.e. typical activities of event management
2. Provide technical infrastructure for event participants to run interoperability and compliance tests across alternative implementations of an identified set of standards.
3. Capture results of testing, and provide pre-event and post-event material and information to participants and the public, and archive results for future use.

The typical pains of event organisers are that while event management itself has a number of best practices, it can grow into a painstakingly complex issue for organisers that are not event management professionals. Cloud Plugfests target technicians and software developers who are often overloaded with the complexities of event organisation beyond technical infrastructure (point 1 above). This causes distraction from the main objective of identifying interoperation and has been a factor in hampering the success of Cloud plugfests.

The value proposal of the Cloud plugfest initiative therefore should consequently target the common pains and gains of all Cloud plugfest event organisers. While local facilities organisation and management is out of question for service offerings by the initiative, it is surely within reach to consider developing or including existing checklists for facilities provisioning, to at least ease the pain where complete relief is impossible.

The Cloud Plugfest Initiative's (CPI) gain creators need to address the main gain of current organisers, which is information on interoperability (or the lack thereof) of their own implementation towards alternatives. Commercial participants often see this as mission-critical business intelligence. Rightfully, CPI responded with providing NDA/Confidentiality agreement templates that must be signed by all participants where required.

To reduce the administrative burden, CPI has collected a number of tools and services that primarily target the second and third purposes enumerated earlier. These comprise of<sup>7</sup>:

- Mailing lists (general information, and announcements)
- Event wiki
- Presentations archive
- Code repositories, community wiki, Task and progress tracking tools
- Test reporting tool (defunct)
- Plugfest in-event wiki
- Plugfest chat-room / web conference
- WebEx conferencing

Already, these tools cover support for remote plugfest participation. In their current state, however, these are still primarily configured for F2F usage with offline coordination with a fairly static and traditional approach of usage and provisioning.

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<sup>7</sup> As captured from <http://www.cloudplugfest.org/tools> on 18 March 2016

An updated value proposition for Cloud plugfests needs embedding in a sustainable business model; we have identified one possible business model for cloud plugfests as follows. Anticipating that a portion of Cloud plugfest activities may require continuous service availability, we believe that higher education and/or training institutes may benefit from sustaining Cloud plugfest activities as a vehicle for practical education and vocational training in the following ICT topics:

- Professional IT Service Management (ITIL, ISO 20000, etc.)
- Software engineering education in professional Cloud service delivery
- Standards development, profiling, assessment and certification techniques
- Business strategy management and delivery

As already indicated before, however, these opportunities would require a careful analysis by interested stakeholders, which is beyond the scope of this document. Nonetheless, we consider it vital to indicate a way forward along and will test-drive this new model through plugfests organised through CloudWATCH2.

## **4 Virtual plugfests: A model for future interoperability testing**

We consider the issues identified in section 1 as threats to the sustainability of cloud plugfests. They indicate that a business model and inherent value proposal that worked at some point in the past now needs adjusting to ensure the continued relevance of these events to stakeholders and hence sustainable in the long term.

In this section we propose changes to the value proposition and service catalogue to the Cloud Plugfest Initiative (CPI). We will also give a brief outline of underlying business models to provide some context. A fully developed business model including a value proposition is beyond the scope of this document and the CloudWATCH2 project; they are the scope and responsibility of stakeholders that might be interested in sustaining the plugfest activities. While CloudWATCH2 may support the discussion and formation of a sustaining consortium through other means of support within the merit of the project, this document and associated activities focus on the technical aspects of the value proposition and its implementation.

To address the primary objectives of cloud plugfests as introduced in section 1 we consider the following services for implementation.

### **4.1 Self-service conformance test service**

During the experience journey, conformance testing is one of the first practical steps encountered in the endeavour of implementing a standard. The implementer needs to ensure that the service conforms to a given specification (in this case a standard) as a result of a business decision at some earlier point in time. She must do so in the most efficient way possible, and deviation/diversion is undesirable if not outright unwanted or a potential deal breaker. While the standards support implementation itself is out of scope for this service, it is closely related to conformance testing in that both activities are often hampered by the lack of availability of code samples, let alone open source reference implementations. Having to deal with a blob of code, scripts and other artefacts written by others, and spending the effort to get it to run is a considerable effort every software developer has to carefully consider each and every time.

A service providing automated, self-service conformance testing for either side of the M2M conversation (i.e. typically a client and a server-side implementation) would be a very valuable time saver for implementers. It would provide a reliable and deterministic source of measuring progress towards full conformance of the implementation under testing. It would free the developer from setting up and maintaining a test instance, that itself would require measurable effort to ensure that it would produce reliable (and conforming!) results.



Standards Development Organisations (SDO) are potential customers of such a service as they can collect information on adoption of standards in an automated way.

Provisioning and operating such a service would benefit from existing open source implementations and even reference implementations that one could turn into such a service with reasonable effort. Albeit relatively straightforward, such a service could serve as a direct model outlet for a sustaining stakeholder interested in implementing the business model described in section 3.

Although such a service is not strictly in scope for cloud plugfests, we consider this a significant component of a more comprehensive service catalogue supporting developers in their effort of implementing standards.

## 4.2 Virtual plugfests: Cloud-based interoperability testing with scalable infrastructure

As outlined in section 1 tighter travel budgets prevent physical participation at plugfests. Providing virtualised plugfests resolves this and allows remote participation.

Accelerated development and release cycles (as manifested in DevOps and other agile methodologies) increase the individual developer's required time of presence and dedication to the project/product<sup>8</sup> reduce time available for absence from the development cycle. Staying inhouse while participating in a plugfest increases stakeholder assurance of rescheduling and reassigning developers in time of urgent problem solving needs. Absent developers on a business trip to a plugfest are still much less effective in troubleshooting scenarios.

Past plugfests mostly revolved around conformance to and compliance with OCCI and CDMI. In those past years dearly these specifications received a lot of attention. By applying Gartner's hype cycle, these specifications were in the hype phase and hence plugfests around these were well attended. With specifications maturing and attention dropping (comparable to the "trough" phase) plugfest participation has also dropped correspondingly.

Virtualising plugfests helps turning these into much more agile events, allowing easier expansion to other cloud related specifications and topics, such as data protection and privacy. In this document CloudWATCH2 has addressed technical issues of organising virtual cloud plugfests. Non-technical and fundamental changes and alignments need a broader scope and support of other stakeholders.

We consider including virtual plugfests in interoperability event portfolio vital to the sustainability of any adopting organisation, including the CPI. Staying within the remit of the CloudWATCH2 proposal, we propose a model for entirely virtualised plugfest events, and to validate the model by explicitly making use of the proposed model (and amend where need is evident from previous plugfests) to include significant remote participation on eye-level to physical presence.

## 5 Virtual plugfests: Implementation

Reviewing the NIST cloud characteristics analysis, virtual plugfests infrastructure shall be:

- **On-demand self-service** – "instantiate" customisable infrastructure tools and services for a specific event.

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<sup>8</sup> Agile methodologies all have one fundamental business strategy in common: Optimising an individual developer's efficiency and efficacy by reducing the number of projects and products they need to pay attention to at the same time, while maintaining the load (as *opposed* to increasing it)

- **Broadly accessible** – while network access is a must, AuthN and AuthZ should be as pluggable as possible.
- **Elastic** – Allow multiple, parallel plugfests (if need be) as well as plugfests of any size, and tools need to accommodate varying numbers of simultaneous access by participants who may come and go in a virtual plugfest scenario.
- **Measured** – while there may be varying requirements per event organiser, tools should accommodate collecting measurements in a reasonable fashion. Tools should allow for easy collection and aggregation of plugfest results for the benefit of participants and other stakeholders.
- **Scalable** – Large concurrent (and collaborative!) use of tools is necessary to allow parallel documentation of results of plugfests. While non-concurrent tools can be used in F2F situations using offline communication, this is much more difficult in virtual environments with reduced communication means.
- **Virtualised** – where external tools and services are not feasible (which may or may not be realised as virtualised), self-operated tools and services shall be virtualised to accommodate other virtual plugfest characteristics.
- **Low-cost software** – with tightened budgets, low-cost software and service (freemium, free for education, etc) may be the most fundamental enabler for providing such a service as discussed in this deliverable.
- **Resilient** – Stable and mature software allows smooth and efficient operation, increasing efficacy of testing, and collecting results.
- **Secure** - virtual plugfests shall pay increased attention to AuthN and AuthZ balancing out natural physical access constraints of F2F plugfests. Also, while offline tools and testing of conformance and compliance are easier to handle with respect to data privacy, there are ways to work around these issues when virtualising plugfests.

Primarily, though, the plugfest infrastructure tools and services need to:

#### Pre- and post-event infrastructure

- Provide efficient and effective outreach and communication facilities for event preparation
- Provide a facility for long-term event result archiving and publication
- Capture both participants, and registrants(!) of a plugfest, their affiliation, and other necessary information
- NDA signing facility, and publication privacy settings

#### In-event infrastructure

- Provide document sharing and collaborative editing;
  - in a scatter pattern, for efficiently distributing instructions, etc.
  - in a P2P pattern, e.g. for two participants recording their findings
  - in a gather pattern, e.g. where all (or a large part) of participants collaboratively, collectively, and simultaneously work on/in the same document
- Provide chat and audio facilities allowing for
  - Plenary communication
  - Ad-hoc group formation
  - Person to person communication; not for private talks, but so as not to disturb other plugfest communications
- Provide a storage facility to drop log files etc. that are meant as interop evidence, and not for collaborative editing

## 5.1 Virtual Plugfest tools and services

Our strategy for sourcing tools and services for virtual plugfests needs to address a dilemma many initiatives see themselves confronted with: In order to keep participation free of charge, the cost of service must be kept very low and needs to at least consider tools and services that are available for use at no service charge. Unfortunately, using free services usually comes at the expense of granting the service provider a royalty-free license to do almost anything with both collected as well as stored data (“content”) as they see fit. The implications and possible circumvention strategies are discussed in section 5.2.

We have already a collaboration established with the Cloud Plugfest Initiative which has provided the CloudWATCH2 project with a user account to use for planning and operating cloud plugfests. The Cloud Plugfest Initiative currently maintains a legacy Google Apps free edition<sup>9</sup> which offers a number of service components that are otherwise available only for a service fee.

### 5.1.1 Participant registration – Eventbrite

We want to keep the service free of charge. Eventbrite<sup>10</sup> allows using their services free-of-charge for any number of events that are free of charge themselves. Eventbrite offers a wide range of registration options, different “ticket” categories and options, as well as data export options for easy post processing.

Eventbrite provides only API-level authentication using OAuth, which is beyond the scope of the current virtual plugfest implementation. Eventbrite manages their own database of users; any plugfest organiser may decide to use Eventbrite or not for their registration needs.

### 5.1.2 Outreach and communications – MailChimp

It is important to keep participants informed. Contrary to discussion forums etc., unidirectional communication is a very good vehicle for providing newsletters, announcements, etc. for any general communications, but also to provide preparatory material to participants of specific plugfest events.

We choose to use MailChimp for such purposes for two reasons: (a) The Cloud Plugfest Initiative already uses MailChimp for announcements and newsletters, and (b) we would use Mailchimp to set-up per event communication mailings for registered participants.

### 5.1.3 Eventresult archiving and publication – Google Sites

The Cloud plugfest initiative already uses Google sites to provide website content for the initiative. We would use Google Sites to provision per-event pages for long-term publication of results (subject to participant consent for publication, whether anonymised or not) as well as an archive location for compressed raw event data. Google Sites is not available as a free service for personal users, but it is part of Google Apps users, irrespective using the legacy free edition or the paid version.

### 5.1.4 NDA and data and privacy protection

NDA agreements can easily be built into event registration processes by providing a standard NDA on the public event page and referring to it in the Eventbrite registration process.

Data and privacy protection are provided by the tools and service selected for virtual plugfests. All selected services were reviewed for reasonable data protection and privacy policy provisions. We have *not* conducted diligent legal reviews of the terms and conditions of the individual services, however we paid

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<sup>9</sup> As of 6 December 2012 Google stopped offering this service to new customers. Existing users can continue using this service for free until they decide to stop using it: <https://support.google.com/a/answer/2855120?hl=en>

<sup>10</sup> <https://www.eventbrite.com/>

reasonable attention to provider policies with respect to content stored within their services. Section 5.2 provides more information.

#### 5.1.5 Document sharing and collaborative editing – Google Drive

This service's availability must be restricted to the event only. Access and modification to shared documents must stop as soon as is possible and feasible so as to ensure results, logs, and other evidence of interoperability will be available in an unmodified state.

We recommend using Google Drive for this. Drive Documents and Spreadsheets allow for scalable and simultaneous access by large numbers of participants with near real-time update of edited content, which is perfect for events such as plugfests. Drive Documents can be used for in-event setup instructions, descriptions of common test cases etc. Drive Spreadsheets will be used for an overview testing matrix for interoperability on the first worksheet. Subsequent worksheets may be used to detail interoperability test results and suggestions.

#### 5.1.6 Chat and audio/video facilities for event participation – Google Hangouts,

Google Hangouts is a service free to use for anyone – a Google account is not even necessary for this to work (Google calls these “external guests”).

Google Hangouts offers chat, audio and video conferencing and is a perfect candidate for panel conferences. Group or personal chats and conferences can be set ad-hoc, or even using other services that the targeted participants support.

#### 5.1.7 Storage facility for log files and other evidence – Google Drive

Similar to document sharing, this service component's availability must be restricted to the event only. Google Drive is a very suitable and scalable service with very reasonable storage capacity for no additional cost. Google Drive provides both storage of uploaded files, and online office documents, spreadsheets, presentations, etc.

### 5.2 Virtual plugfest data protection and privacy strategy

Beside technical requirements, the strategy for virtual plugfests must also address data protection, privacy, and last but not least content protection.

The general dilemma at hand is the conflict between keeping the cost of service low to maintain free (or close to free) participation in plugfests, and the selection of tools and services for providing and operating plugfests. Physical plugfests, i.e. participants meeting in person at a given facility, use local infrastructure (often provided for free by the local host) to obtain results, and then leave again, are capital expenditure type of meetings that neatly fit into the CAPEX model of project funding predominantly found in academia and public funding programmes such as FP7, H2020 etc. in Europe and similar worldwide.

Virtual plugfests on the other hand much more fit the cloud paradigm where operational expenditure offsets otherwise much higher capital expenditure of physical plugfests. Challenges in the operational sustainability of (virtual) plugfests drives providers towards using free tools and services wherever possible, and accounting staff effort as voluntary contribution.

While this dilemma is not new and applies to many different sections, business models and innovative ideas, it plays out in a particular way for plugfests as follows. Standing in as examples of such free tools, albeit using different wording, Microsoft's SkyDrive service agreement<sup>11</sup> and Google's Drive Terms of

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<sup>11</sup> <https://www.microsoft.com/en-us/servicesagreement/>

Service for personal Google accounts<sup>12</sup> make the same provisions for Microsoft and Google, respectively, in terms of rights of access to one's content stored in their Cloud. The sensitive statement in Google Drive's Terms of Service for personal accounts (i.e. free usage) is this (emphasis by the authors):

"[...]  
Your Content in our Services  
[...]  
When you upload, submit, store, send or receive content to or through our Services, you give Google (and those we work with) a worldwide license to use, host, store, reproduce, modify, create derivative works (such as those resulting from translations, adaptations or other changes we make so that your content works better with our Services), communicate, publish, publicly perform, publicly display and distribute such content. **The rights you grant in this license are for the limited purpose of operating, promoting, and improving our Services, and to develop new ones.** This license continues even if you stop using our Services (for example, for a business listing you have added to Google Maps).  
[...]"

Despite Google publically stating that the practical implementation of these provisions are such as to improve their services and add new features<sup>13</sup>, they are sufficiently termed allowing Google to enter into direct competition with any business storing data that way in Google Drive. These provisions are most likely the reason for businesses not allowing employees using Google services for business activities – yet, employees still use Google services simply for practical reasons, contributing to the often lamented shadow IT.

These provisions, along with similar conditions are not present altogether in the Google Terms of Service<sup>14</sup> for Google Drive with Google Apps (for Business) accounts. From a technician's point of view Google's privacy and data protection policies for Google Apps for Work are reasonably safe<sup>15,16,17</sup>:

- Google maintains continuous certification according to ISO 27001
- Google maintains independent verification of its conformance to ISO 27018:2014
- Google explicitly states that data is processed solely for the purpose of delivering described services to the customer – and at the same time clarifies that this is different for users of their free services (i.e. with a personal account)
- Google encrypts data at rest in its services, and explains which elements and how.
- Google uses transport layer encryption between users and its data centres
- Google uses transport layer encryption also for traffic between its data centres.
- Furthermore, Google implements "perfect forward secrecy" as is endorsed by the Electronic Frontier Foundation<sup>18</sup>.

Anyone with a subscription to Google Apps for Business will enjoy these different terms of service – including the Cloud Plugfest Initiative using a legacy Google Apps free edition provisioned before December 2012

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<sup>12</sup> <https://www.google.com/policies/terms/>

<sup>13</sup> e.g. see this support answer: <https://support.google.com/drive/answer/2733115?hl=en>

<sup>14</sup> [https://www.google.com/intx/en\\_in/work/apps/terms/2013/1/premier\\_terms.html](https://www.google.com/intx/en_in/work/apps/terms/2013/1/premier_terms.html)

<sup>15</sup> [https://support.google.com/work/answer/6056650?hl=en&ref\\_topic=6055719](https://support.google.com/work/answer/6056650?hl=en&ref_topic=6055719)

<sup>16</sup> [https://support.google.com/work/answer/6056693?hl=en&ref\\_topic=6055719](https://support.google.com/work/answer/6056693?hl=en&ref_topic=6055719)

<sup>17</sup> [https://www.google.com/intx/en/work/apps/terms/dpa\\_terms.html](https://www.google.com/intx/en/work/apps/terms/dpa_terms.html)

<sup>18</sup> <https://www.eff.org/deeplinks/2013/08/pushing-perfect-forward-secrecy-important-web-privacy-protection>

Nonetheless, with our aim to implement virtual plugfests using Google services, we must clarify which Terms of Service apply in a mixed usage scenario as follows. Supposing using a Google Apps account to provision the virtual plugfest infrastructure, delegates may contribute

- a) Using their organisation's Google Apps account,
- b) Using their personal Google account,
- c) Being anonymous by not using any Google account.

Since we intend to use both Google Drive office documents (documents, spreadsheets, etc.), as well as shared folders for participants to upload files into, we need to clarify for each usage scenario and each of the three access scenarios which Terms of services will apply – this particularly important as we also target commercial participation to cloud plugfests.

Through interaction with the support team for Google Apps (different from the support unit for personal Google accounts), we can confirm the following applicability matrix for

1. Google document created using a Google Apps (GApps) account, and
2. Google drive folders created using a GApps account,

And then shared appropriately with plugfest participants:

GApps-created resource	Plugfest participant access means		
	GApps account	Personal account	Anonymously
Document	GApps	GApps	GApps
Folder	GApps	Personal	n/a

**Table 1: Terms of Service applicability when accessing a plugfest resource using a Google Apps account ("GApps"), a personal Google account ("Personal"), or using anonymous access.**

Appendix A details the E-Mail exchange with the Google support team underpinning the results shown in Table 1.

Considering the Google Drive Terms of Service for access with Google Apps accounts sufficiently safe for virtual plugfests with commercial participation, we need to focus on dealing with the use of Google Drive for file and folder upload. From a participant's point of view, anonymous access to plugfest infrastructure is beneficial, since no identity provisioning, authentication and authorisation would be necessary. This is, however, detrimental to the needs of plugfest organisers, since anonymous access would allow *anyone* to change the documents and uploaded evidence for interoperability, let alone having somewhat control over who uses the infrastructure and who does not.

Ruling out anonymous participation, and access to plugfest infrastructure, the only problem to solve is participants using personal Google accounts to upload files and folders to the plugfest event infrastructure.

The E-Mail response detailed in section 7.2 describes a workaround allowing users using their private Google account to upload data into a shared Google Drive folder with Google Apps for Work Terms of Service applying to it:

- Provide a simple Web-based upload form allowing file uploads
- Share this form with plugfest participants,
- Attach a Google Script authorised to run under a Google Apps for Work account
- Implement the script so that it stores the file under said GApps account in the plugfest event drive.

### D3.1 Structure and aspired outcomes of Cloud Interoperability Plugfests



Such an addition to the portfolio allows operating any plugfest event under the Google Apps for Work Terms of Service. A proof-of concept has been implemented and tested under working conditions using Google Sites and Google Drive along with one Google Apps for Work account and a personal Google account, confirming the validity and feasibility of this approach for future cloud plugfests.

## 6 Conclusions

In our endeavour to analyse and propose a new approach to cloud plugfests that address the most prevalent issues with face-to-face plugfest events as they are currently conducted, we needed to address three important yet distinct aspects:

- What are the core objectives of cloud plugfests, whether physical or virtual/online? Do they differ, and how are stakeholder needs addressed in either model?
- What changes on the facilities and infrastructure side? What is their overlap, and which differences have an impact on the value proposition of plugfests?
- Changing from a physical to a virtual plugfest, remote digital infrastructure plays a much more important role. What are the implications for data protection, privacy and content protection?

We firmly believe that we have proposed a viable and workable solution that does not require measurable operational expenditure from any of the involved stakeholders. Nonetheless, acceptance of this model eventually lies with the plugfest participants (provided our model and its security implications are clearly communicated) and their accepting the Google Terms of Service for Google Apps for Work account governed plugfest infrastructure. Notwithstanding our confidence in this model, we plan to exploit the three physical cloud plugfests scheduled as part of CloudWATCH2 (T3.2) as a safe vehicle to validate the concept and implementation, and enable a transition phase from mostly physical presence to remote and even entirely remote presence at cloud plugfest events.

Our roadmap for this plan is laid out as follows: Although the proposed plugfest infrastructure is theoretically suitable for full automation, implementing this is beyond the remit of the project. We therefore chose to stay with harmonising and streamlining manual operation of the infrastructure instead.

**Pre-MS12** – Seek agreement with the Cloud Plugfest Initiative. Prepare the suggested infrastructure described in section 5 towards TRL 4; the vast majority of components are already at TRL 9 (Eventbrite, Mailchimp, Google services) leaving harmonisation of service usage for improvement.

**MS12 First plugfest [M12]** – Conduct a plugfest using the proposed infrastructure. Record any unexpected deviations from the manual execution plan, validating it towards TRL 5. Alpha-test the infrastructure and instructions.

**Deliverable 3.3 [M13]** – Summarise the results of the first plugfest, and record necessary changes to the plugfest infrastructure.

**MS13 Second plugfest [M18]** – Improve the infrastructure and usage instructions before validating it in the second plugfest. Recruit a consortium partner to join plugfest preparation and execution, and to follow the usage instructions for validation in a beta test fashion borrowed from software testing principles. Record deviations from expected procedures and processes.

**MS 14 Third pugfest [M23]** – Further improvement of the infrastructure before the plugfest towards TRL6. Recruit a consortium partner to join plugfest preparation and execution, and to follow the usage instructions for a second beta testing round.

**Deliverable 3.7 [M24]** – Summarise the results of the third plugfest, including a progress assessment over the course of the project. Compare infrastructure usage and administration patterns recorded at MS12, MS13 and MS14, and provide a near-complete instruction document for others to use. Provide an outlook on the work ahead, indicating potential partners and initiatives that may decide addressing long-term sustainability of plugfests following this mode.

Furthermore, the current operations of the Cloud Plugfest Initiative rely on a legacy Google Apps for Work free edition, which is limited to 10 user accounts, which means that some of those accounts are repeatedly used and recycled for plugfest events. This is not scalable, and we believe that, with progressing automation of the system, we can reduce this to one account permanently used to serve plugfest organisers in provisioning necessary documents, Google Site wikis and pages, Google Drive folders and documents, and share these with the event organiser using their individual Google account outside of the Cloud Plugfest Initiative organisation.

## 7 Appendix A

The following subsections detail the relevant E-Mail responses in a conversation between Google support, and the author of this document regarding Terms of Services applicability – and with this, implicitly, whether or not a license to use stored content is granted to Google and its third party partners, is issued.

All conversation took place on 24 March 2015; for privacy reasons, E-Mail metadata is removed, but available upon request.

### 7.1 Terms of Service applicability for Google Drive documents

The following conversation between the author of this document and the Google support team regarding applicability of Terms of Service for Google Drive office documents (Documents, Spreadsheet, etc.) clarifies which Terms of Service will apply for shared documents:

*"Hello Michel,*

*I hope this message finds you well. My name is Detelin and I am the technical supervisor on site regarding collaboration matters. My colleague Dimitar tried to call you on the phone but could not reach you. Although I believe an email would best address your questions.*

*I would like to inform you upfront that we cannot interpret legal Help Center articles, however, the question you would like answered, as far as I understood from my colleague is the following "If I, a Google Apps for Work user, share a file owned by me with a user with a free account, which ToS will apply?" The latter question is in between technical and legal part so I can address it with certainty. The answer to this question is Google Apps for Work ToS will apply on the document since I, the Google Apps for Work user, am the owner of the file. You can also refer to the following Help Center article:  
<https://support.google.com/drive/answer/2450387?hl=en>.*

*[...]*

*Sincerely,*

*Detelin*

*Google for Work Support*

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*Case: #08942952*



*Subject: Questions regarding terms of service for Google Drive*

*+++*

*ref:\_00D00VNwG.\_50060wwGV0,00D6GEAW.5006V0AAM:ref'*

## 7.2 Terms of Service applicability for Google Drive files and folders

The following conversation between the author of this document and the Google support team regarding applicability of Terms of Service for Google Drive office documents (Documents, Spreadsheet, etc.) clarifies which Terms of Service will apply for files and folders created in Google Drive:

*"Hello Michel,*

*Thank you for your message and the clear examples.*

*As you mentioned you need an official confirmation, and having in mind messages from [esupport@google.com](mailto:esupport@google.com) is official information I will answer your questions below. Please have in mind that the user account owner of the file's ToS will apply no matter whom the file is shared with:*

*"I, as a Google Apps for Work user, create a folder in my Google Drive service instance, and share this folder with other people outside of my GApps for Work organisation. These people may, or may not have a Google Apps for Work account (though with a different organisation). Which ToS apply to files added to said folder, when the file is*

*a) Uploaded using a GApps for Work account*

*- Google Apps for Work ToS of the user who uploads/creates files/folders*

*b) Uploaded using a personal Google account*

*- Google accounts ToS of the user who uploads/creates files/folders*

*c) Uploaded using no Google account (is that even possible)?"*

*- Not possible. The user who uploads/creates a file/folder is the owner of it, therefore if not logged into any kind of Google account a person cannot upload/create a file/folder, but can only view what you share with him/her.*

*- - If you need a functionality like this, we do not officially offer it. There is a workaround very well explained in the following third party article:*

*<http://www.labnol.org/internet/receive-files-in-google-drive/19697/>*

*In this workaround, the ToS of Google Apps for Work will apply, because the files will appear owned by you as the Google Apps for Work user*

*Regarding the other question, "I as a GApps for Work user have created and shared a folder with other people outside my organisation, and allowed them to upload files. Which ToS apply once that user has transferred ownership to me?"*

*- That is not possible, ownership of files can be transferred only between users in the same Google Apps account, e.g. users in your Google Apps for Work account even between secondary domains, and also between Gmail consumer users only for Google format files as if Gmail accounts are in a big Google Apps account.*

*Please let me know if the provided information above addresses all your questions or if there is more I can do to assist you and I would be happy to get back to you as soon as I receive your reply.*

*Have a weekend and holiday to you too, Michel.*

*Sincerely,*

*Detelin,  
Google for Work Support “*

## 8 Log Table

DOCUMENT ITERATIONS		
v1	ToC and initial sections	Michel Drescher & David Wallom, OERC
v2	First full version	Michel Drescher & David Wallom, OERC
v3	Internal review	Nicholas Ferguson Trust-IT & Damir Savanovic, CSA
v4	Edits based on internal review	Michel Drescher, OERC
v5	PMB review	CloudWATCH2 PMB
vFinal	Final version	Michel Drescher, OERC