

Welcome to the World of Standards



Cloud Standards Coordination – Phase 2 Presentation of reports

B. Becker, E. Darmois, A. Kingstedt, O. Le Grand, P. Schmitting, W. Ziegler

Cloud Standards in the Digital Single Market

Brussels, 28 January 2016



Rationale for CSC phase 2

○ **EC Cloud Strategy (09/2012)**

- “Faster adoption of cloud computing throughout all sectors of the economy to boost productivity, growth and jobs”.

○ **Some potential roadblocks identified by EC**

- Fragmentation of the digital single market
- Contractual issues
 - SLA; Data ownership & portability; Security; ...
- A jungle of standards

○ **The Cloud Standards Coordination**

- “Promote trusted and reliable cloud offerings by tasking ETSI to coordinate with stakeholders in a transparent and open way to identify by 2013 a detailed map of the necessary standards (inter alia for security, interoperability, data portability and reversibility)”

CSC Phase 1

Main conclusions



Cloud Standards Coordination

Final Report

November 2013

VERSION 1.0

NO
Jungle of
Standards

Enough
Standards
to start with

Despite new
standards
coming, some
gaps
identified

Foster
collaboration
to ensure no
fragmentation
happens

A teal-colored circle containing the text "User Needs".

User Needs

A dark red circle containing the text "Security & Inter-operability".

Security &
Inter-
operability

A purple circle containing the text "Standards Maturity".

Standards
Maturity

A blue circle containing the text "Open Source & Standards".

Open
Source &
Standards

- **Build on the findings of CSC Phase 1**
 - Aligning previous findings with ongoing and finished efforts
- **Focusing on the user needs and viewpoint**
 - Testing them against users' feedback
 - Digging further into users' needs—specify/qualify concerns
- **Addressing the main issues outlined at the end of CSC Phase 1**
 - Users priorities
 - Interoperability & Security
 - Standards and Open Source
 - Status of Cloud Computing Standardization, snapshot 2
 - Socialization, Liaisons and Dissemination

○ The Experts

- | | |
|--------------------|--------------------|
| • Bernd Becker | EuroCloud |
| • Emmanuel Darmois | CommLedge (leader) |
| • Anders Kingstedt | Softarc AB |
| • Olivier Le Grand | Orange |
| • Peter Schmitting | FSCOM |
| • Wolfgang Ziegler | z-rands |

○ The Timeline

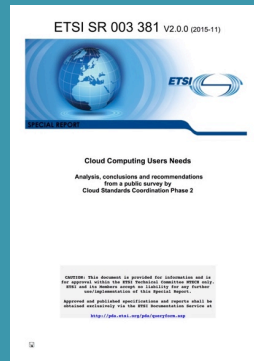
- | | |
|--|-------------------------------|
| • Official Start Date: | January 19 th 2015 |
| • Actual Start Date: | February 1 st 2015 |
| • Planned End of Work: | January 28 th 2016 |
| • Result Presentation Workshop in Brussels | |
| • Official End : | January 31 st 2016 |

CSC Phase 2

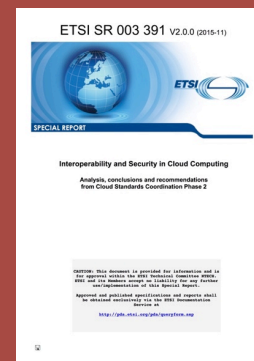
Four reports



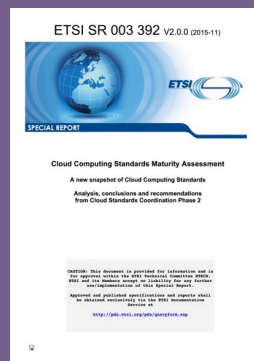
User needs



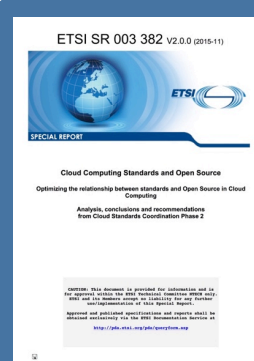
Interop & Security



Standards Maturity



Standards & Open Source



○ **Four reports have been produced**

- WP 1: Cloud Computing User Needs – based on the survey
- WP 2: CC Standards and Open Source Software
- WP 3: Cloud Computing Interoperability and Security
- WP 4: Cloud Computing Standards Maturity Assessment

○ **An open review process**

- Feedback/comments were open until 25 September
 - More that 450 comments were received and processed
- Final Review Workshop October 1-2, 2015, Brussels

○ **All reports published on November 15th**

- Available on CSC website: <http://csc.etsi.org>

○ **What's now and what's next**

- Cloud Standards in the Digital Single Market
- Brussels, January 28th (aka today)



World Class Standards

The WP2 report Standards and Open Source

- Understand the relationship between Open Source (OS) and standards and vice-versa via the identification of a number of interaction scenarios between Standard Setting Organizations and OSS (not specific to Cloud Computing), some of them already visible and some only emerging.
- Clarify how these scenarios apply to Cloud Computing.
- Collect information upon the perceived strategies and visible actions of the SSOs regarding Open Source, and how they match the above scenarios;
- Collect information upon the perceived strategies and interactions of the Open Source projects towards standardization, especially when the interaction scenario involves one or more of the SSOs relevant in Cloud Computing;
- Propose initial recommendations to foster positive interaction, to suggest areas for collaboration between both communities on ways to support this interaction (e.g. technical frameworks, interoperability, intellectual property).

○ Main content

- 5 Standards and Open Source: purpose, use
 - 5.1 Definitions and objectives
 - 5.2 Different objectives, different approaches
 - 5.3 Main challenges to an efficient interaction
 - 6 Standards and Open Source: Interaction scenarios
 - 6.1 An overall view
 - 6.2 The scenarios
 - 6.3 Current and future situation
 - 8 Better aligning the standards and OSS communities
 - 8.1 Alignment: if and when needed
 - 8.2 Strategies
 - 8.3 Solutions
 - 9 Conclusions and Recommendations
-
- Annex A: Standard Related Organizations Approaches
 - Annex B: Open Source Organizations Approaches
 - Annex C: Case studies
 - C.1 Sharing specifications: NFV and OPNFV
 - C.2 Open Source and Standards: OpenStack

○ Different objectives, different approaches

- The leading force in Open Source is the (source) code
- The leading force in standards is the specification

○ Main challenges to an efficient interaction

- Technical challenges
 - Architecture
 - Incremental releases versus updates
 - Standards documents and source code and more ...
- Organizational challenges
 - Long-term Maintenance
 - Governance
- Intellectual property challenges
 - Open Source Licenses
 - Patent and Copyright Policies

○ **An Open Source community implements standards**

- An SSO Technical Group has developed and published a set of standards – that will be maintained and may be further evolved. This set includes detailed protocol/API standards that can be used for implementation purposes;
- An Open Source community outside the SSO wants to make a reference implementation of these standards – that will be further distributed (by the Open Source community itself or by specialized distributors) and integrated into commercial products under conditions defined by an Open Source License;
- The OSS implementation is set to be fully "compliant" with these standards or can lead to evolutions of the standards published and maintained by the SSO.

- **An SSO develops an Open Source reference implementation**
 - An SSO Technical Group has developed and published a set of standards – that will be maintained and may be further evolved;
 - To speed-up the market adoption, the Technical Group decides to develop a reference implementation of these standards or of a subset of them, using an Open Source methodology and environment (including for testing purpose).

- **An SSO develops standards based on the results of an Open Source community**
 - An Open Source community is designing and developing a software implementation that fulfills the needs of an SSO, e.g. providing an implementation covering the functional and architectural requirements expressed in standards published or under development by that Standards Organization;
 - The Standard Organization decides to endorse the results of the Open Source community and develops standards based on the documented APIs developed by the Open Source community;
 - The Open Source community has opted for an Open Source license.

- **A collaboration (“joint project”) is established between a Standard Organization and an Open Source community**
 - A joint collaboration (“joint project”) between a Standards Organization Technical Group and an Open Source community is established with the objectives of developing together a set of standards and an Open Source implementation of these standards.
 - The set of standards includes standards at various stages of the standards development chain (e.g. standards on requirements, architecture, protocols/APIs) while the Open Source implementation provides a reference implementation of these standards.
 - This collaboration includes the establishment of a joint steering Technical Committee whose tasks is to coordinate the development of standards by the Standard Organization and the development of the Open Source implementation. This Technical Committee will drive the roadmap in terms of use cases, requirements and architecture that should be supported by the Open Source implementation.

○ **Sharing specifications: NFV and OPNFV**

- Scenario: An SSO develops an Open Source reference implementation
- In practice, it is clear that keeping each organization abreast of developments of joint interest is challenging, given the quite different governance processes of ETSI NFV ISG and OPNFV.

○ **Open Source and Standards: OpenStack**

- Scenario: An OSS organization implements Reference APIs
- Amongst the decisions that have to be taken for the project output, the choice of which Cloud Computing standard will be supported is important

○ **Distributed Management Task Force (DMTF)**

- Addressing how the OVF, CIMI and CADF standards developed by DMTF have been adopted in major Open Source projects, i.e. OpenStack and CloudStack.

○ Collaboration

- Encourage collaboration between OSS communities and SSOs working on similar or closely related topics, e.g. NFV and OPNFV, possibly through joint events like workshops, plugtests;
- Encourage the creation of “joint projects” between the SSOs where the standards are developed and Open Source communities in order to push for close relationship, interaction, exchange and cooperation;

○ Roadmaps

- Make sure that collaboration between SSOs and OSS organizations address the known Cloud Computing (standards) gaps, e.g. in Service Level Agreement, Security, Privacy and Integrity;
- Encourage Open Source initiatives to standardize their specifications that are important for interoperability (e.g. APIs: Data Model, Protocol, Format).

○ **Organization**

- Facilitate the implementation of Open Source solutions based on Standards (developed or under development in a SSO);
- Ensure that pre-standardization activities (e.g. those emanating from research projects) can be sustained over a longer period in order to allow for a smooth transition of results within Cloud Computing standardization.

○ **Marketing, dissemination, promotion**

- Encourage SSOs to increase the dissemination and communication efforts with to goal to increase the awareness of plans for/work on new Cloud related specifications, targeting the OSS communities in the Cloud area;
- Engage industrial users of Cloud OSS;



The WP3 report Interoperability and Security

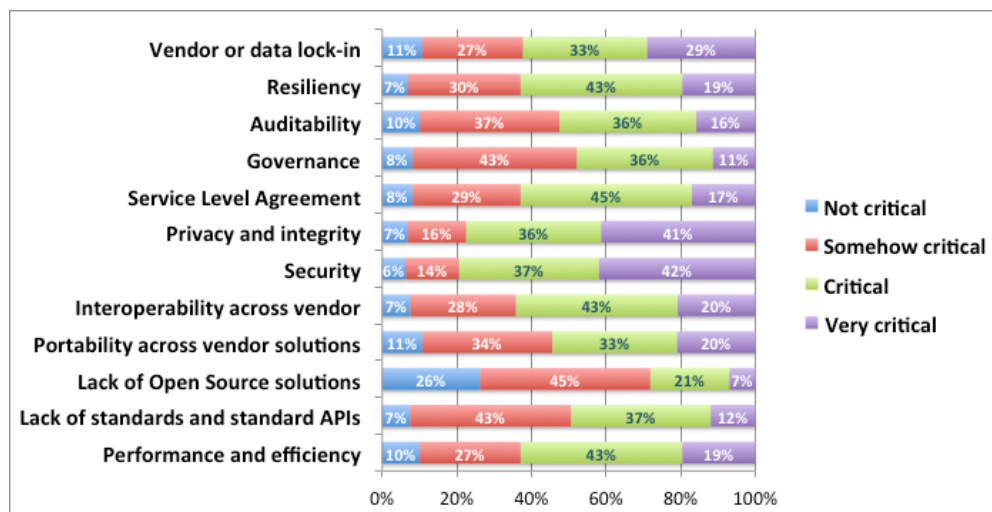
Backdrop

Why? - Interoperability

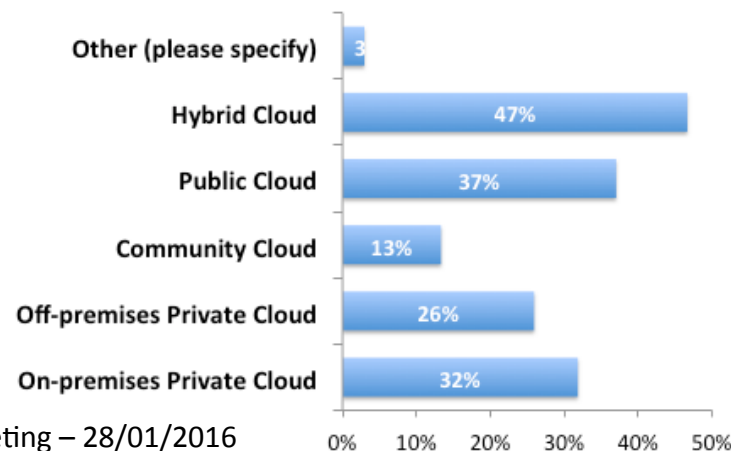


- Lock-in concerns
- The vision of a smooth & effortless integration
 - Across Cloud Services
 - Between On-Premise and the Cloud
- Increased support for Interop & portability will drive adoption of the Cloud

How critical are the following issues for your organization?



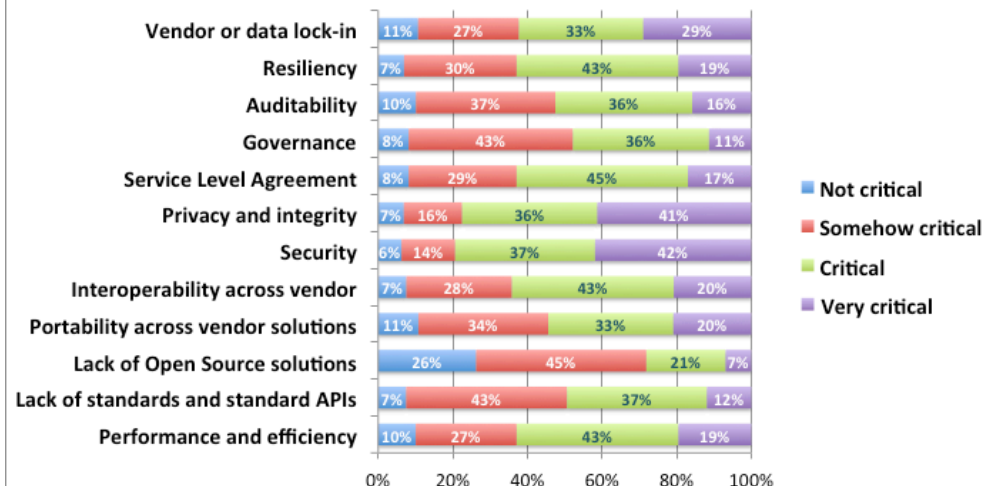
Low use of public cloud scenarios still exists



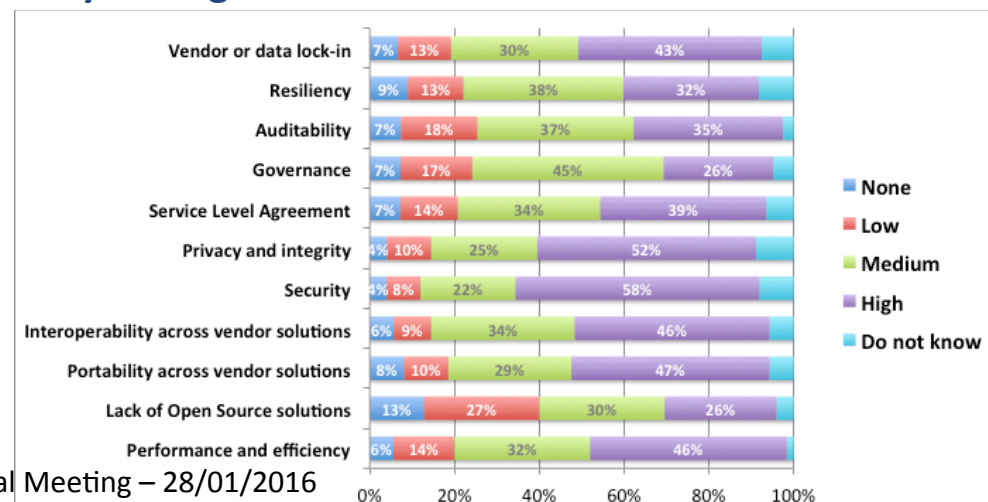
Why? - Security

- Top concern
- Secure access to and use of Cloud services and Cloud Service Customer data are key prerequisites for Cloud adoption
- Standards exist, but they need to be expanded and tailored for Cloud Settings

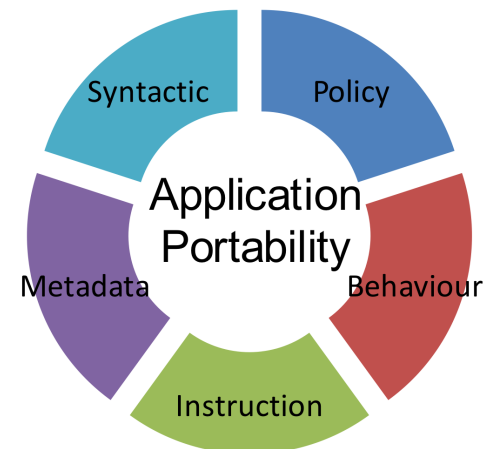
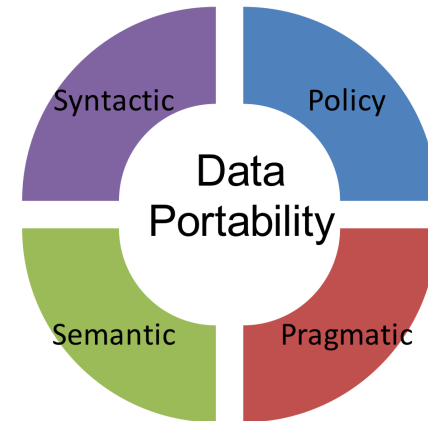
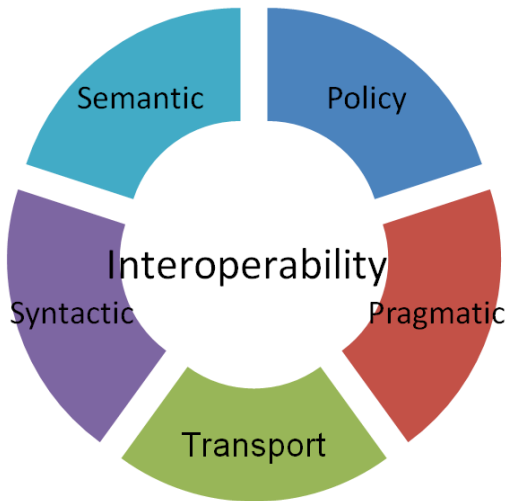
How critical are the following issues for your organization?



Which impact can Cloud Computing Standards have on your organization's concerns?



Facets of interoperability & portability (ISO/IEC 19941, draft)



Aspects of security

Information Security

Privacy (data protection)

Misc concerns

Objectives

Confidentiality

Integrity

Availability

Non-repudiation

Information

Information

PII

Examples:

- Business continuity
- Audit, compliance
- Data isolation
- Incident mgmt.
- Governance
- Change control and configuration mgmt.

Key capabilities

Trust

Identity and Access Mgmt. (IAM)

Cryptography

Security policy mgmt.

Authentication

Authorization

Mandated by

EU directive 95/46/EC

General Data Protection Regulation

National level legislation

Domain specific legislation

○ Security, interoperability and Portability

- The complexity and applicability is cross cutting in nature
- **Security:** a certain level of confusion and lack of knowledge prevents adoption /of Cloud Computing/
- **Interoperability and Portability:**
 - an important (and challenging) cornerstone for friction free exchange between and to / from Cloud services
 - Understanding the facets of interop & portability is key to success
 - APIs between Cloud platforms will ensure easier transition of data and applications



WP 3 – Recurring security concerns



- Data encryption
- Data isolation
- Privacy (Data protection)
- Data interoperability & portability
- Multi-stage authorization
- IAM in hybrid Cloud scenarios
- Contingency planning (data recovery)
- Data categorization (taxonomy, classification etc.)
- Personal Data (PII)

- And, again, the sheer complexity of Security...

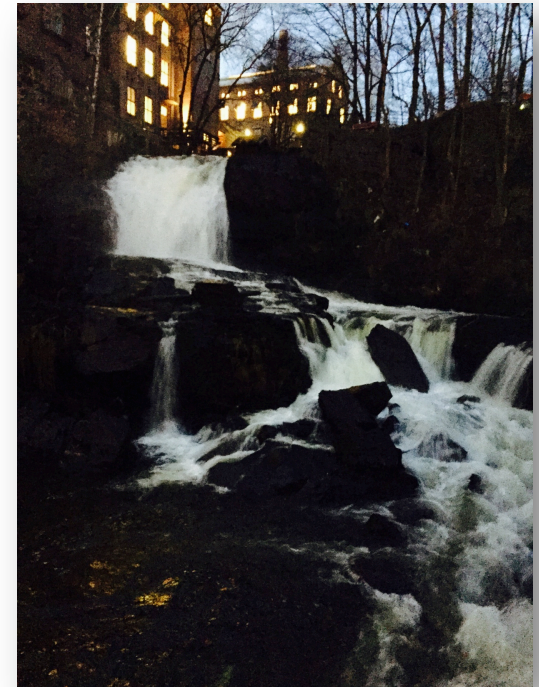


- **The Cloud SLA:** plays an important role in defining the roles and responsibilities and measures required for the safe and controlled provisioning and management of Cloud services
- In particular, the elements of the Cloud SLA will assist in addressing critical areas such as:
 - Acceptable Use Policy (AUP)
 - Security Policy
 - Privacy Policy
 - Business Continuity Policy (BCP)
 - Service Descriptions
 - Service Level Objectives (SLOs)
 - Service Quality Objectives (SQOs)
 - Metrics
 - CSLA requirements



○ Conclusions

- **Risks:**
 - Slow adoption of Cloud Computing
- **Outstanding gaps and key issues:**
 - Interoperability & portability, primarily
 - Interpretation of and general uncertainties related to legal frameworks
- **Awareness, dissemination and marketing:**
 - Key success factor for continued and accelerated Cloud adoption



○ Recommendations and call-to-action:

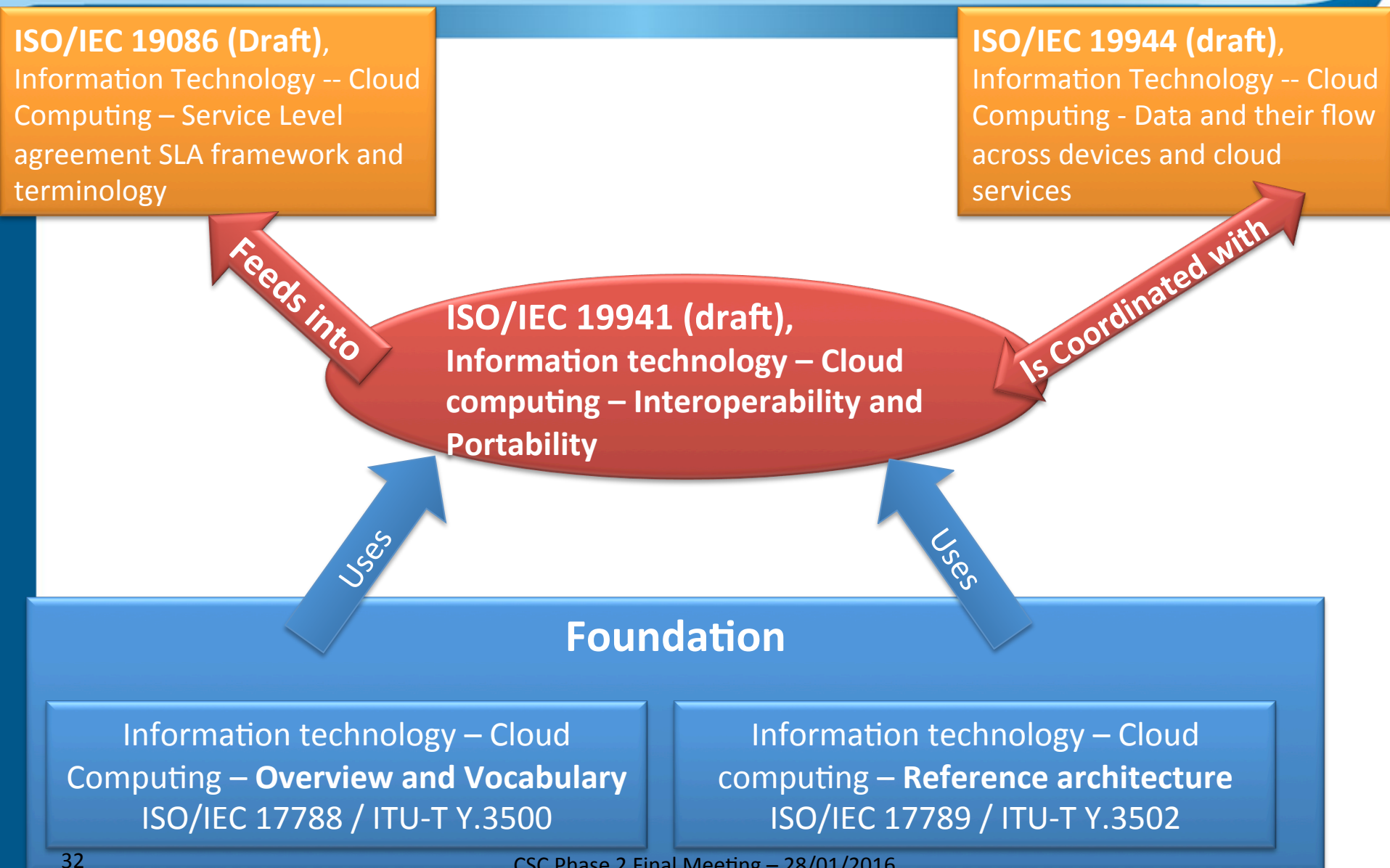
- Start using **already existing standards and solutions**
- Highlight the actual **security benefits** that exists for Cloud Computing
- Increase the use of **certification schemes**
- **Tackle Security issues** by ensuring that your organization has full control of your information
- Ensure that applicable **legal frameworks** are understood and adhered to
- **Start using the Cloud SLA** framework standard when available (expected 2016)
- **Accelerate the Collaborations** between Cloud Computing stakeholders

The **Swedish Pensions Agency**; Report on the use of Cloud Services in the Swedish Public Sector, December 2015:

**PENSIONS
MYNDIGHETEN**

“Cloud Services provide important potential benefits for public authorities, individually and in collaboration. Cloud Services are here to stay. We assess that the use of Cloud Services will increase both in the private as well as the public domain in Sweden”

Making use of standards (example)



○ Questions?



Acknowledgements:

- All organizations who provided feedback on the draft WP 3 report (no one mentioned, no one forgotten...)
- ISO/IEC WG4
- ETSI



The WP2 and WP3 reports Panel Discussion

- Michel Drescher (CloudWatch)
- Alain Pannetrat (Cloud Security Alliance)
- Graham Taylor (Open Forum Europe)
- Jacqui Taylor (FlyingBinary)
- Frank Zdarsky (NFV)



The WP1 report Cloud Computing Users' needs

○ Our objectives

- To collect and analyze (via a survey) the feedback from the users
 - To understand the needs of the CC users community
 - To identify their highest priority (existing or new) use cases
 - To ensure that their priorities are taken into account in standardization.
- To further refine the Phase 1 report conclusions.

○ What we did

- Survey on-line on March 30th to September 25th
 - 378 answers collected for the report
- Draft report distributed (version 1.0) for public comments on June 24th
- Reviewed in the public Review Workshop on October 1st

○ Final deliverable: an ETSI Special Report

○ Benefits and challenges

- Most **positive factors**
 - Reduction of **CAPEX**, improved **business agility**, faster **time to market**
- Main **challenges**
 - **Compatibility with in-house systems, security, privacy/integrity**

○ Adoption and scope

- A **majority** of the respondents (**58%**) have **already started to adopt CC**
- **None (0%)** of the respondents are **NOT** planning to adopt CC

○ Cloud Deployment Models and Cloud Service Categories

- **Private Cloud** dominates followed by **Hybrid Cloud** and Public Cloud

○ Standards top priorities

- **Interoperability, security, service level agreements, portability and APIs**

○ Cloud computing certification standards

- Certification schemes: **a positive way (75%)** to increase confidence in CS Providers

○ Security and Data Privacy are seen as major concerns

- This is **not a new finding**, but the fact that it is still **very much present** is a clear indication on the perceived challenge ahead **for security standards and Cloud certification** in particular.

○ Interoperability is another area that is ranked high

- This concern is **most likely linked to the issue of vendor lock-in and the lack of portability standards** for cross-Cloud scenarios

○ Transition to Cloud Computing

- High perception from the respondents that **it should be carefully planned and organized, in particular in areas pertinent to data (classification, storage, etc.), processes and security.**

○ Role of standards

- It is seen as **important and there is already a high level of awareness**, to a **smaller extent** even in terms of **knowledge on the existing set of standards.**
- Benefit from standards related to Cloud Computing is seen as more critical than Open Source: this finding is however subject to further analysis.

○ **364 responses**

- 48 % from larger Organisations (above 250 employees)
- 52 % from smaller Organisations

○ **Role of your organisation in Cloud Computing**

- 40 % Cloud Customers
- 39 % Cloud Providers, Developers, Brokers
- 21 % others

○ **Stage of Cloud Adoption**

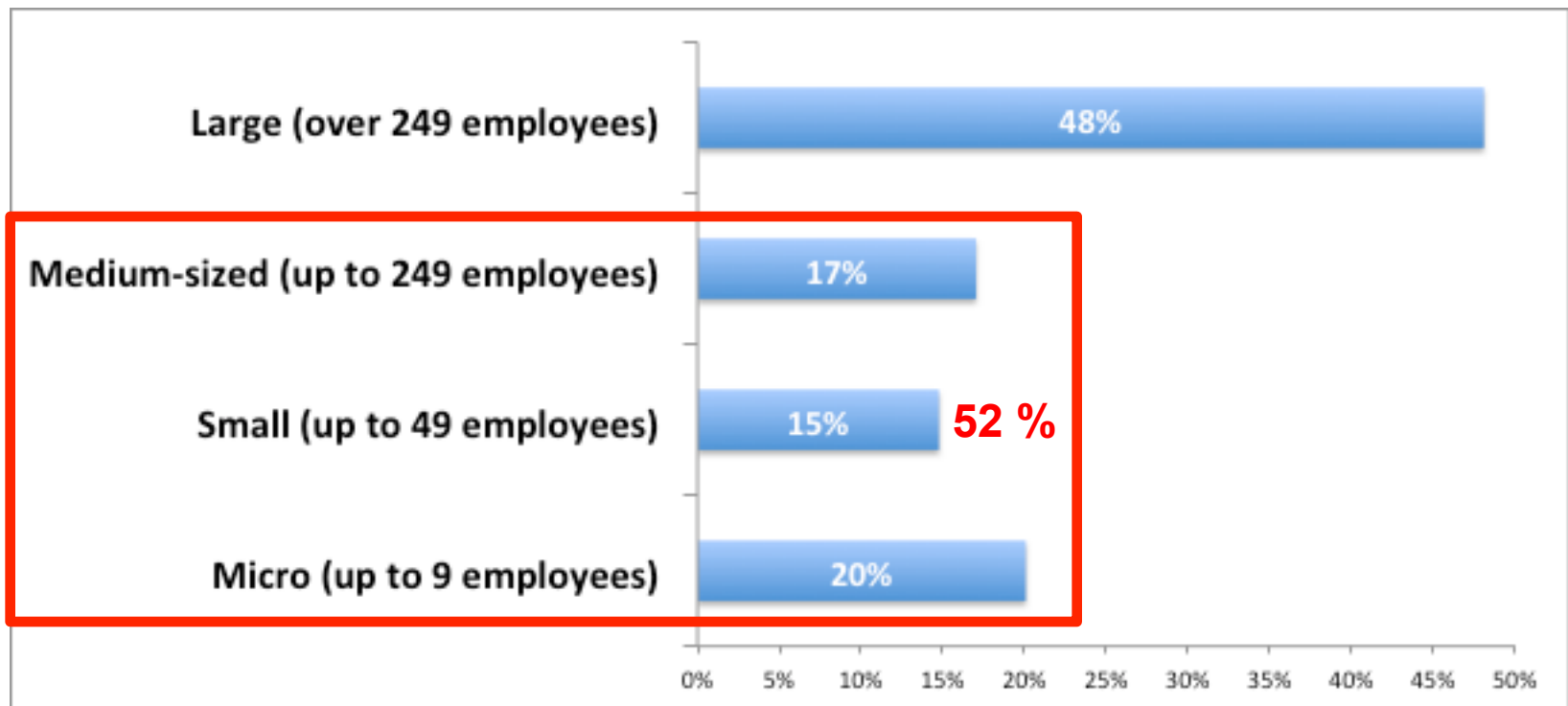
- 51% are already in the Cloud (fully or partially)
- 49% are deploying, piloting, considering

Survey Results

Question 5



Size of your organization?

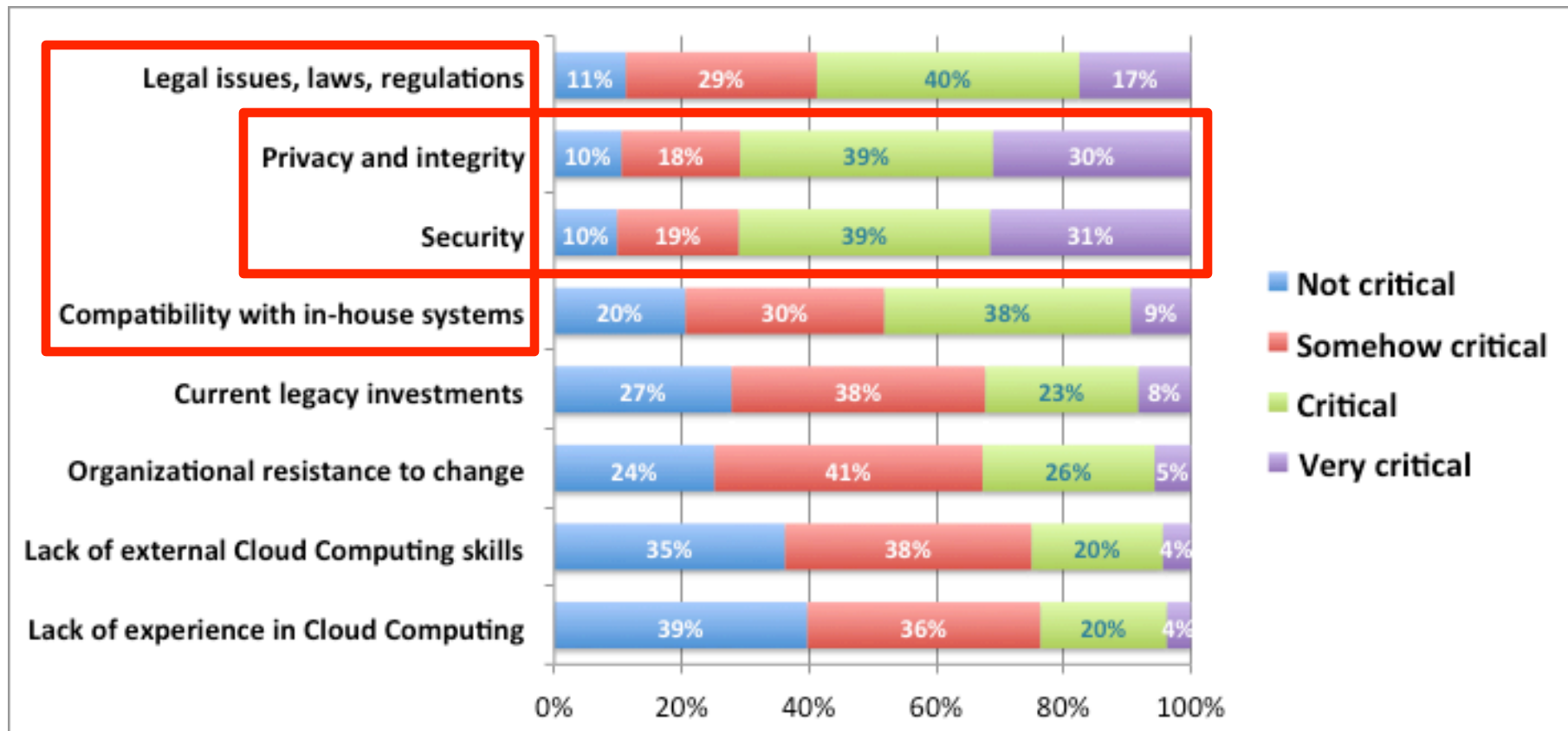


Survey Results

Question 9



Maturity of your organization: how critical are the following challenges?

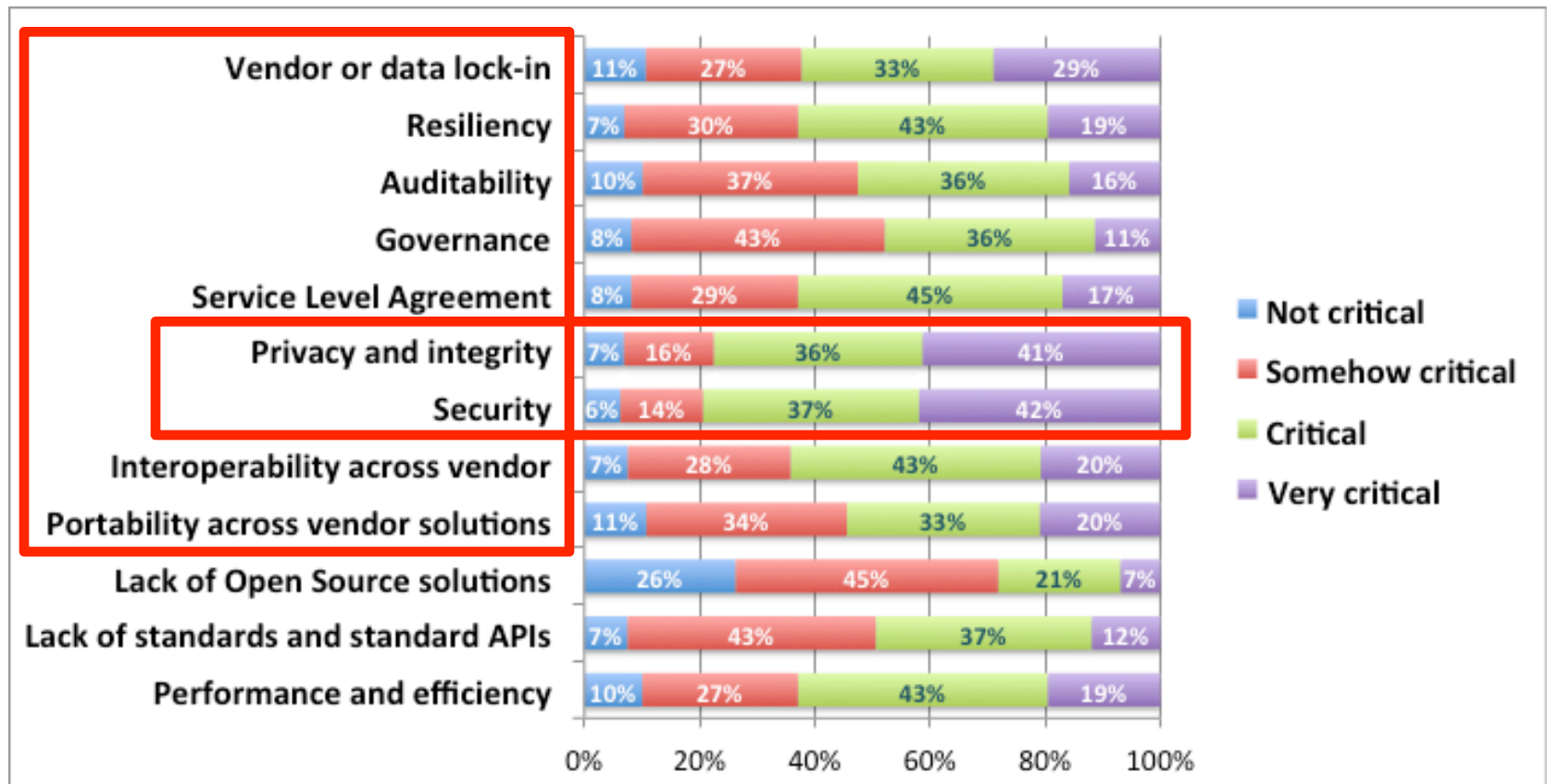


Survey Results

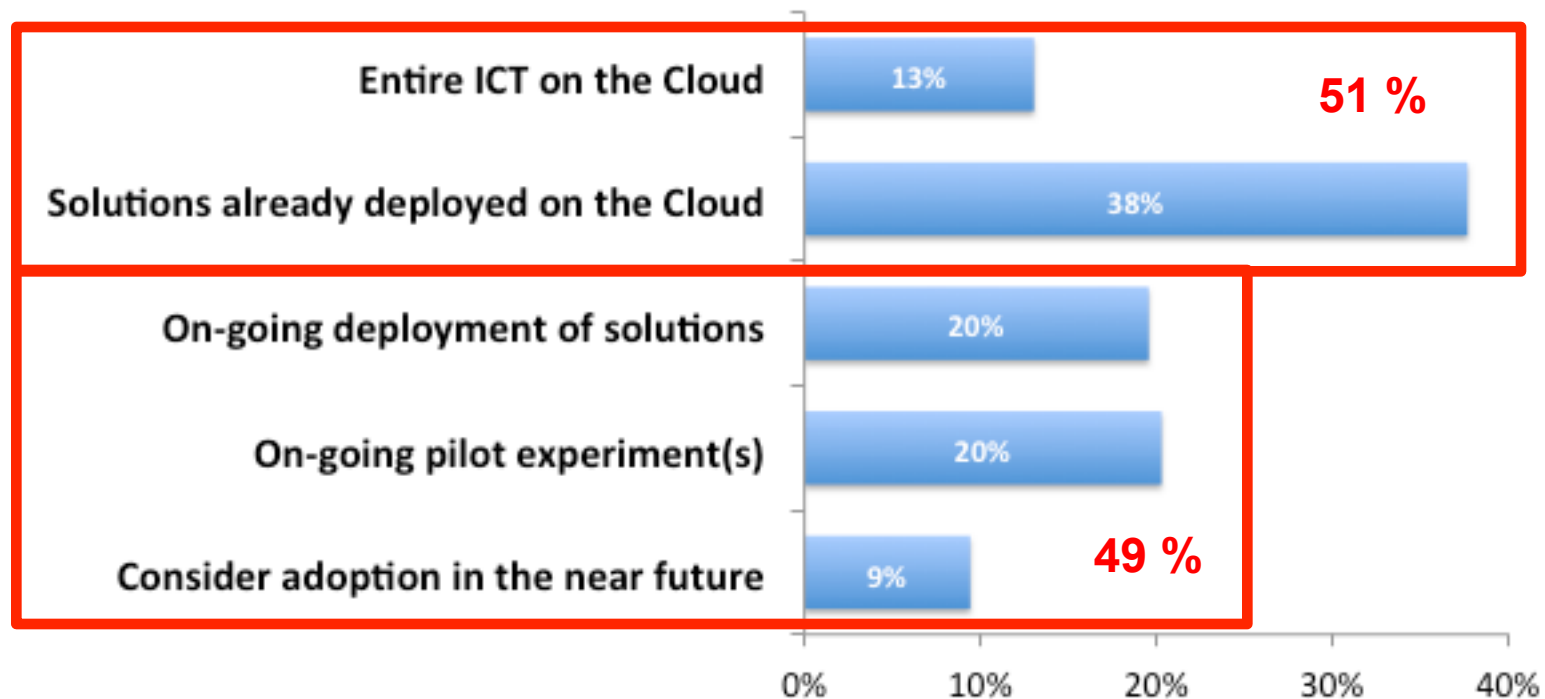
Question 11



Maturity of Cloud Computing: how critical are the following issues for your organization?



Stage of Cloud Computing Adoption

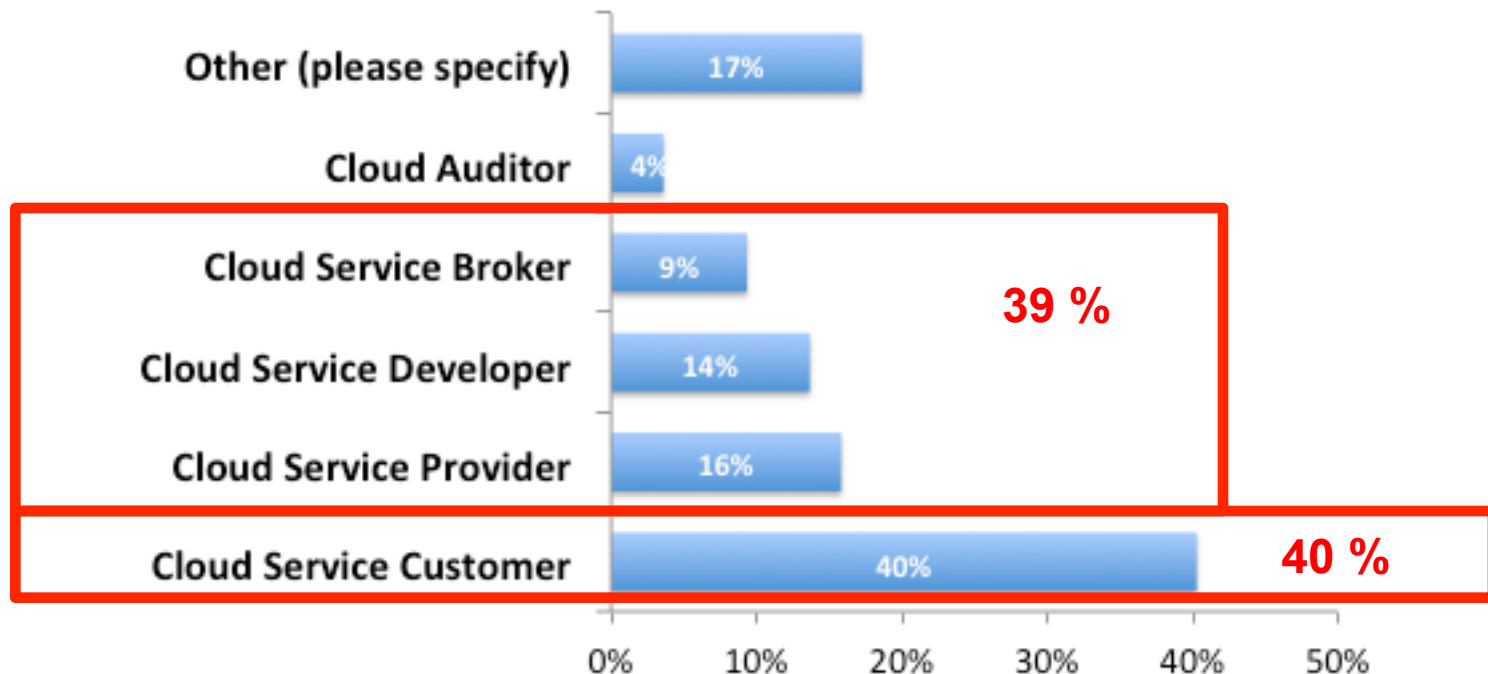


Survey Results

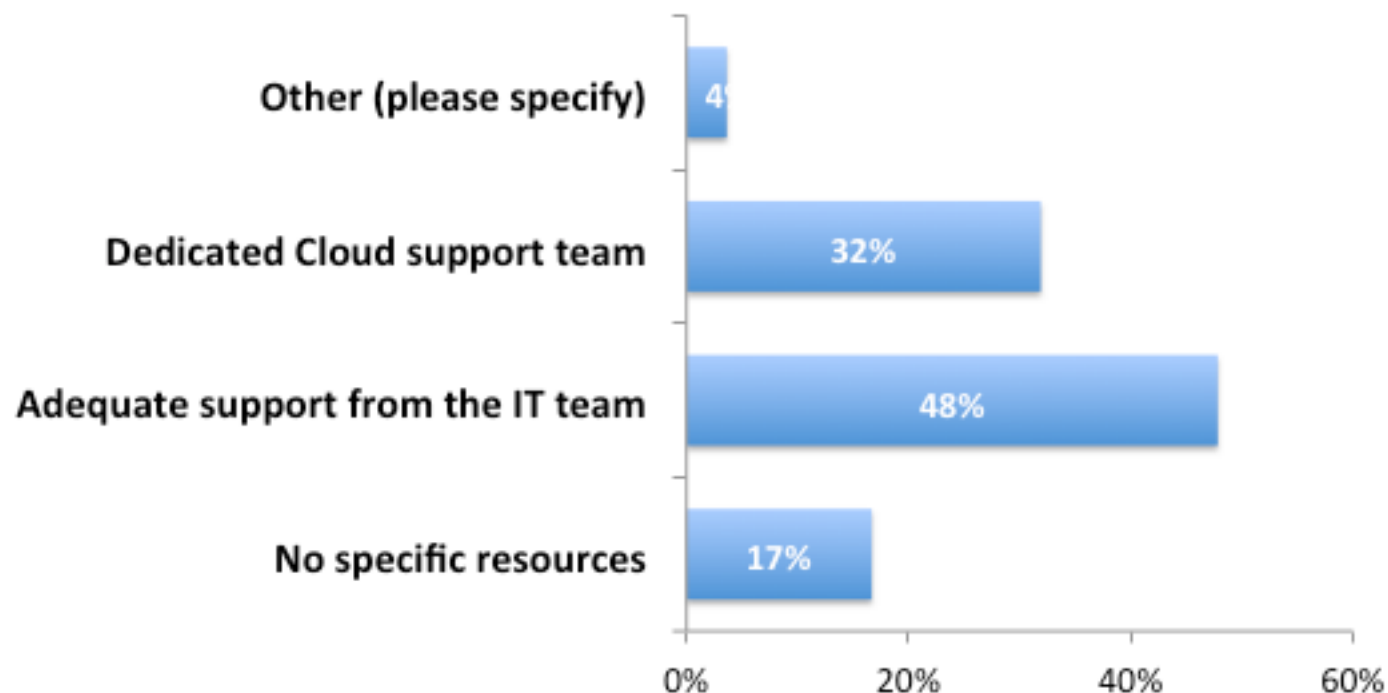
Question 16



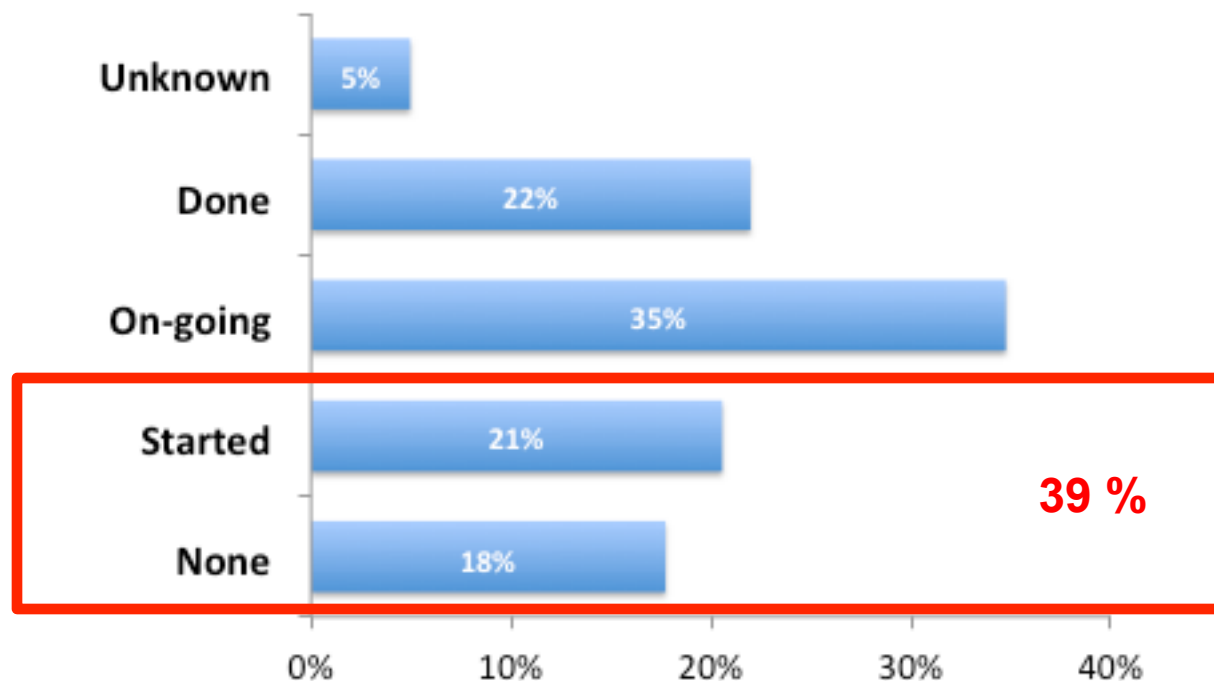
Role of your organization in Cloud Computing



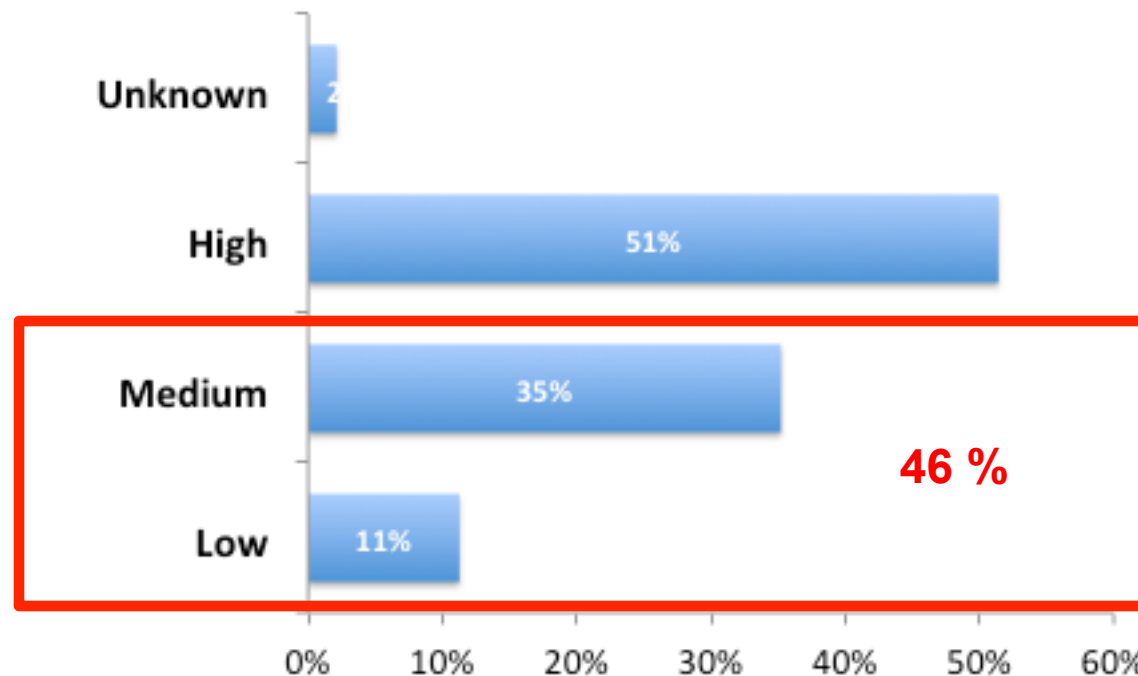
Level of your resources and support to Cloud Computing



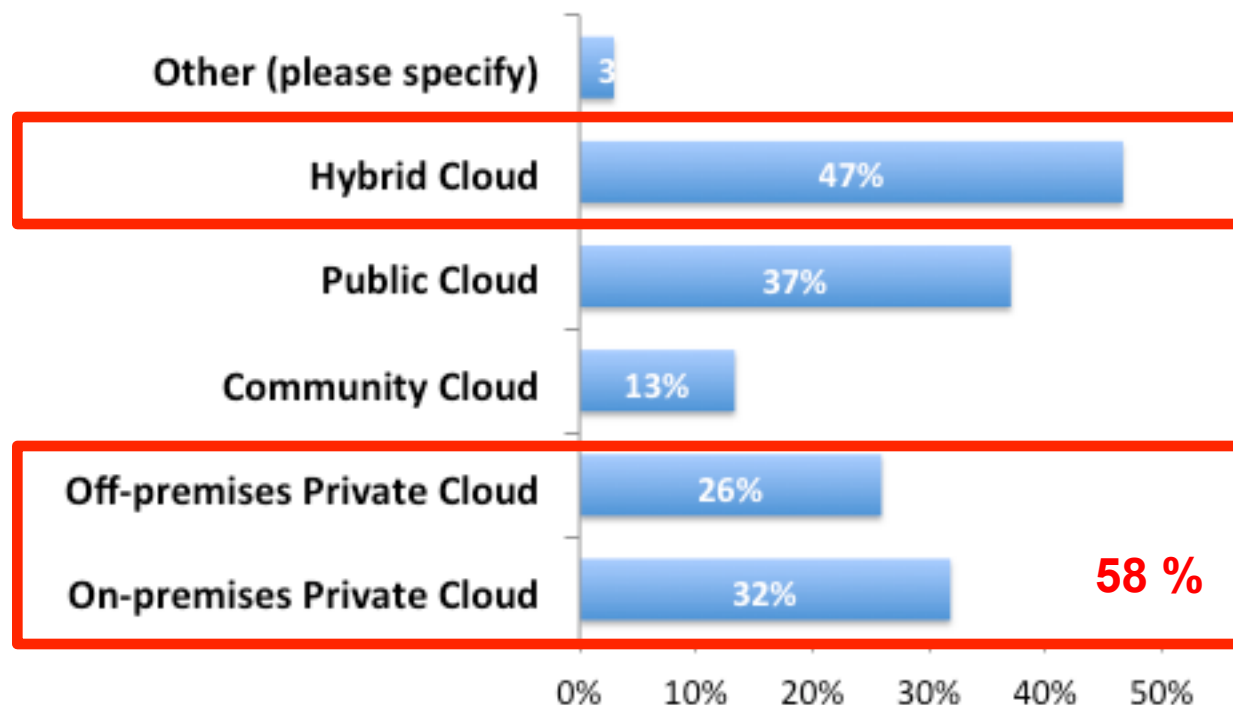
Data Classification in your organization



Data Security in your organization



Which Cloud deployment model seems best fit to your needs?

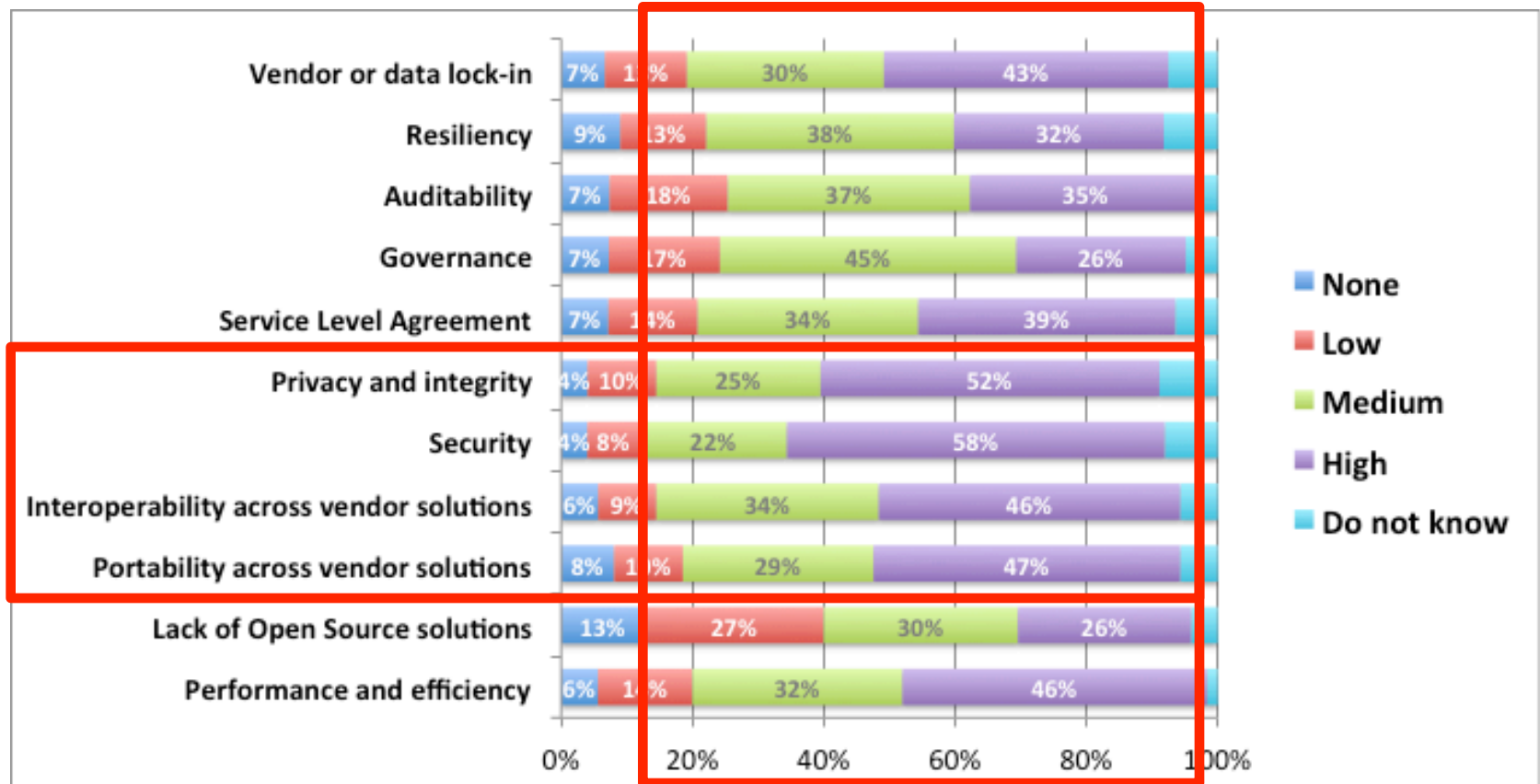


Survey Results

Question 34



Which impact can Cloud Computing Standards have on your organization's concerns?

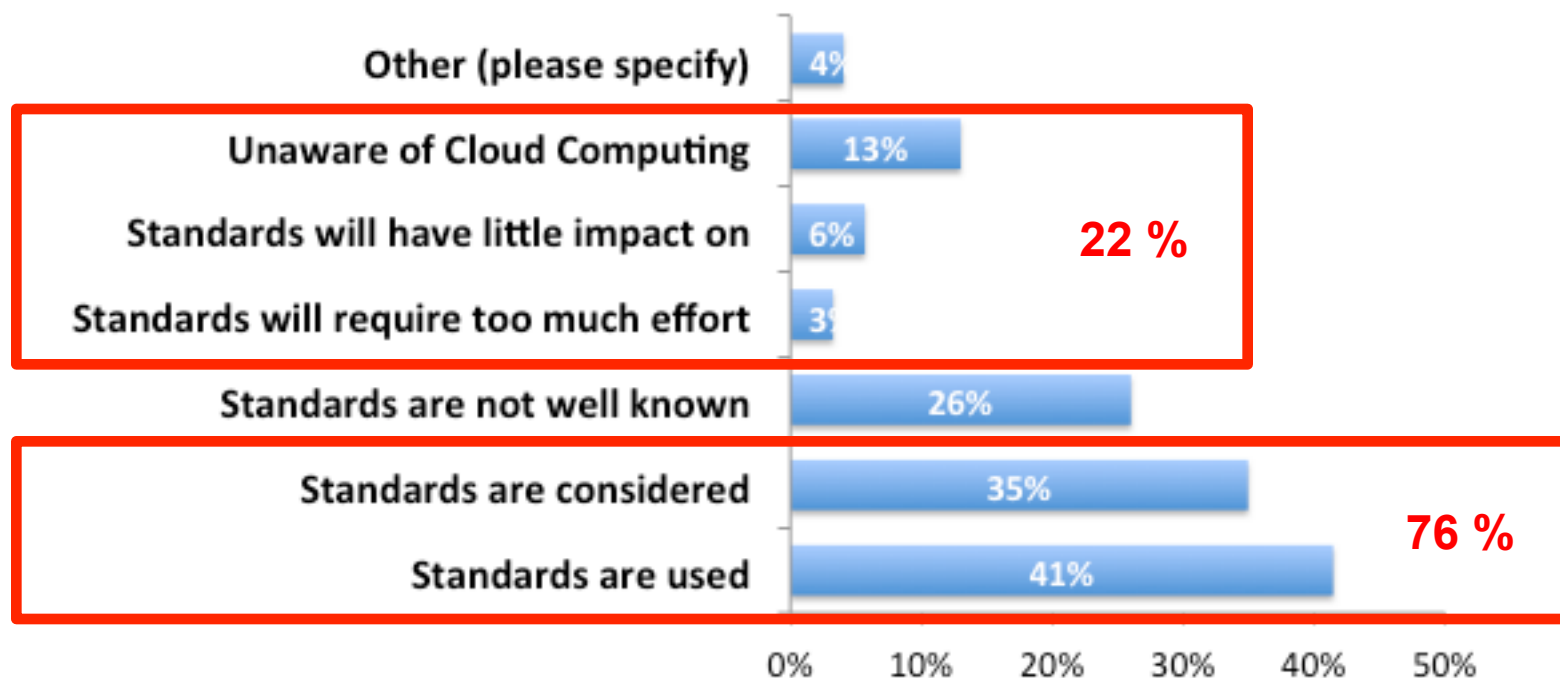


Survey Results

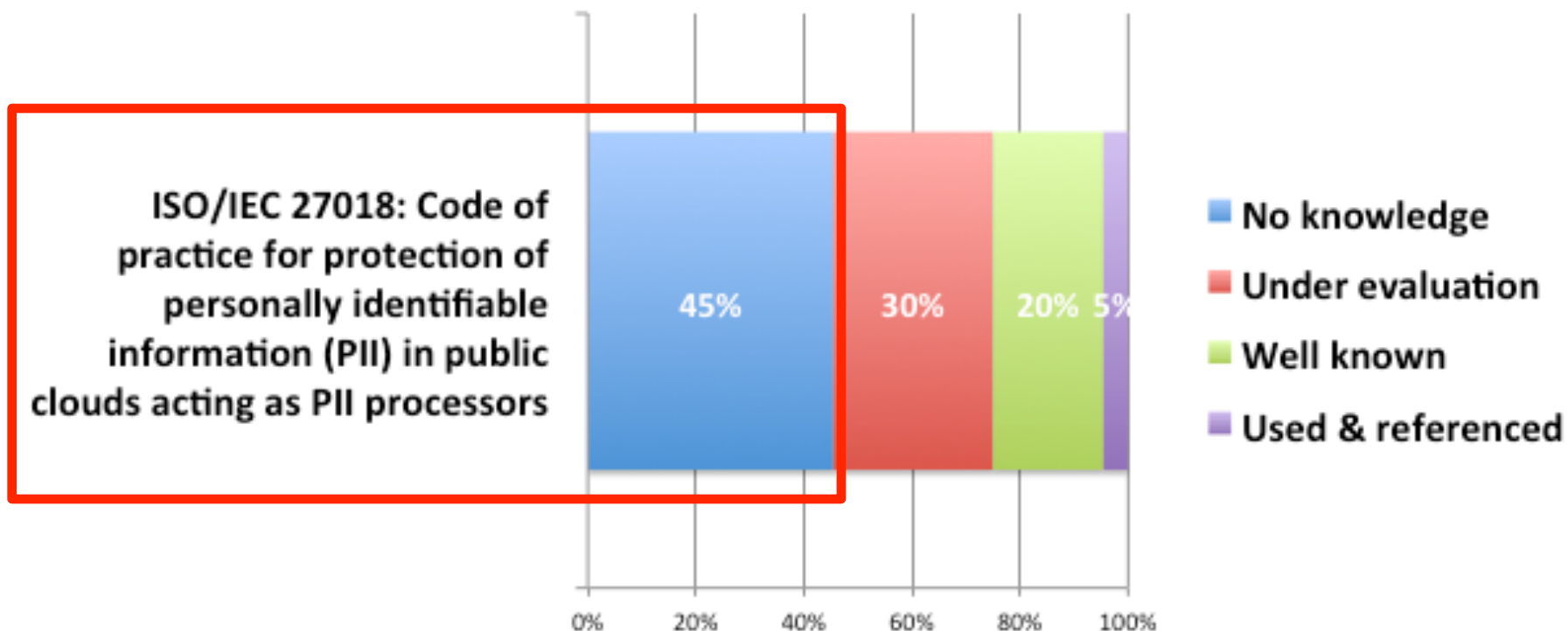
Question 35



To which degree are Cloud Computing Standards considered or used in your organization?



Your organization's adoption and use of CC standards: Data protection

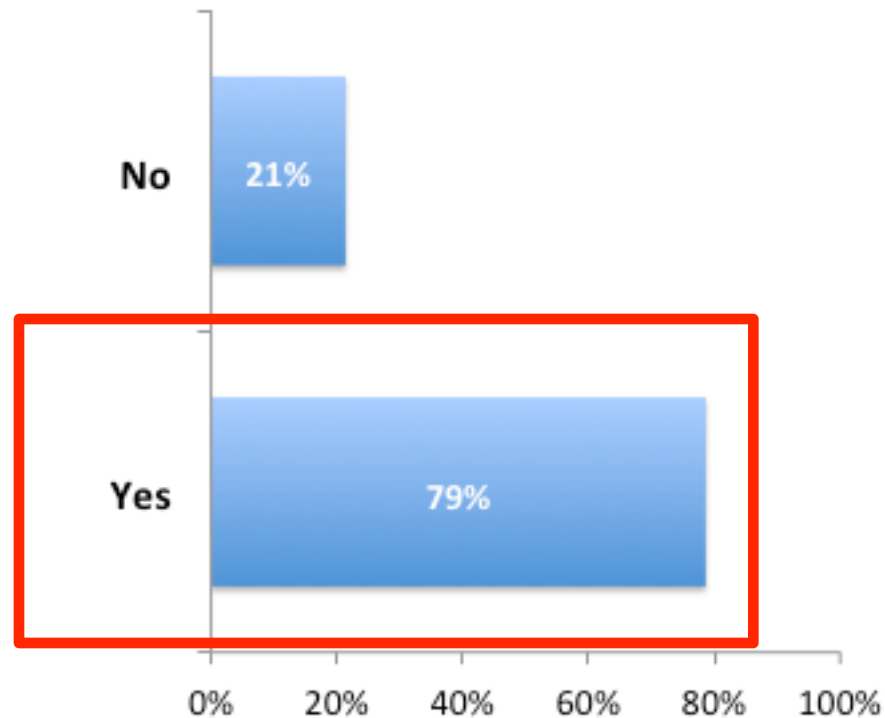


Survey Results

Question 47



Would you consider Cloud Certification as a possibility to improve confidence in Cloud?

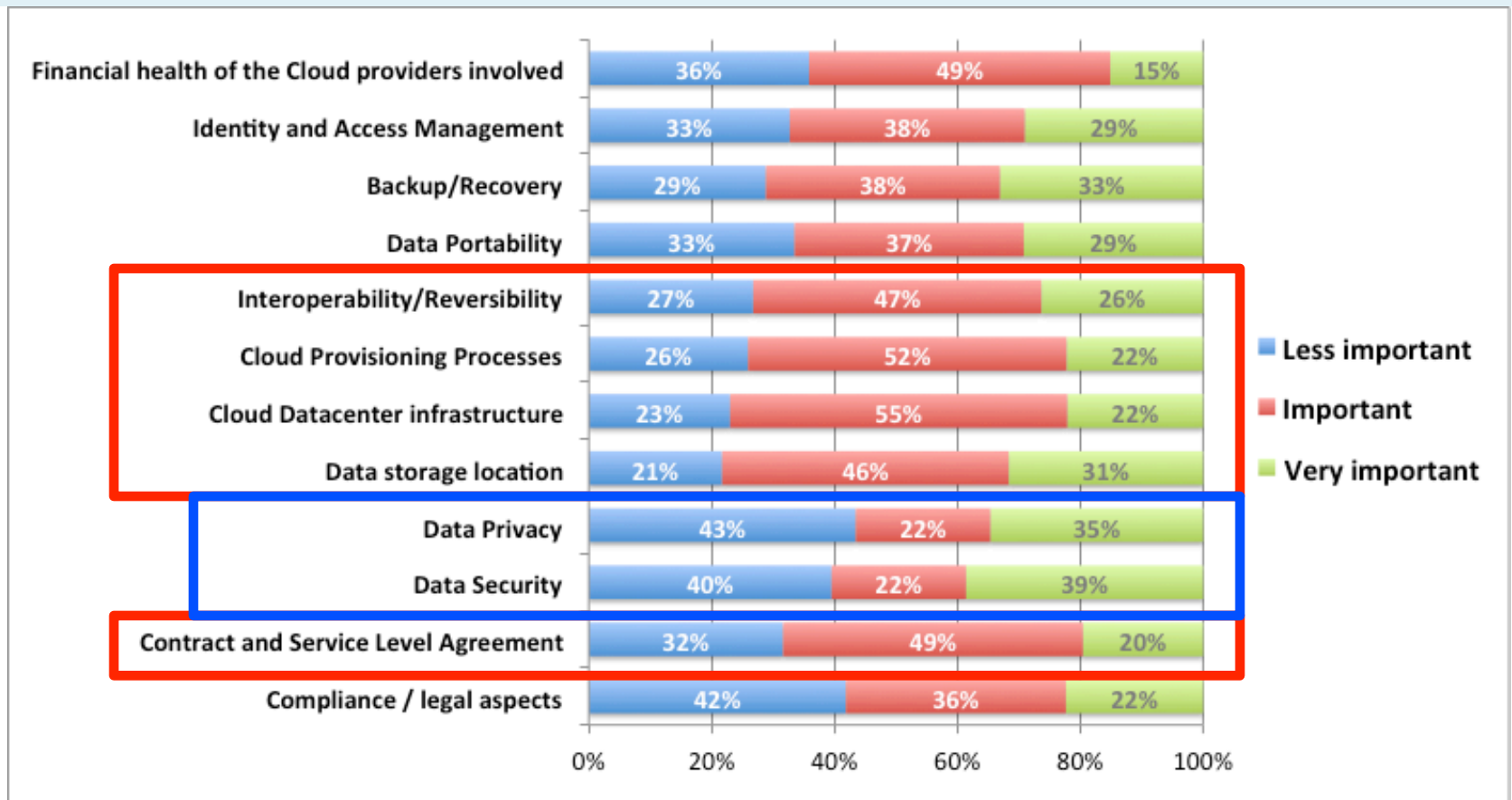


Survey Results

Question 48



Please rank the following Cloud Certification areas according their importance

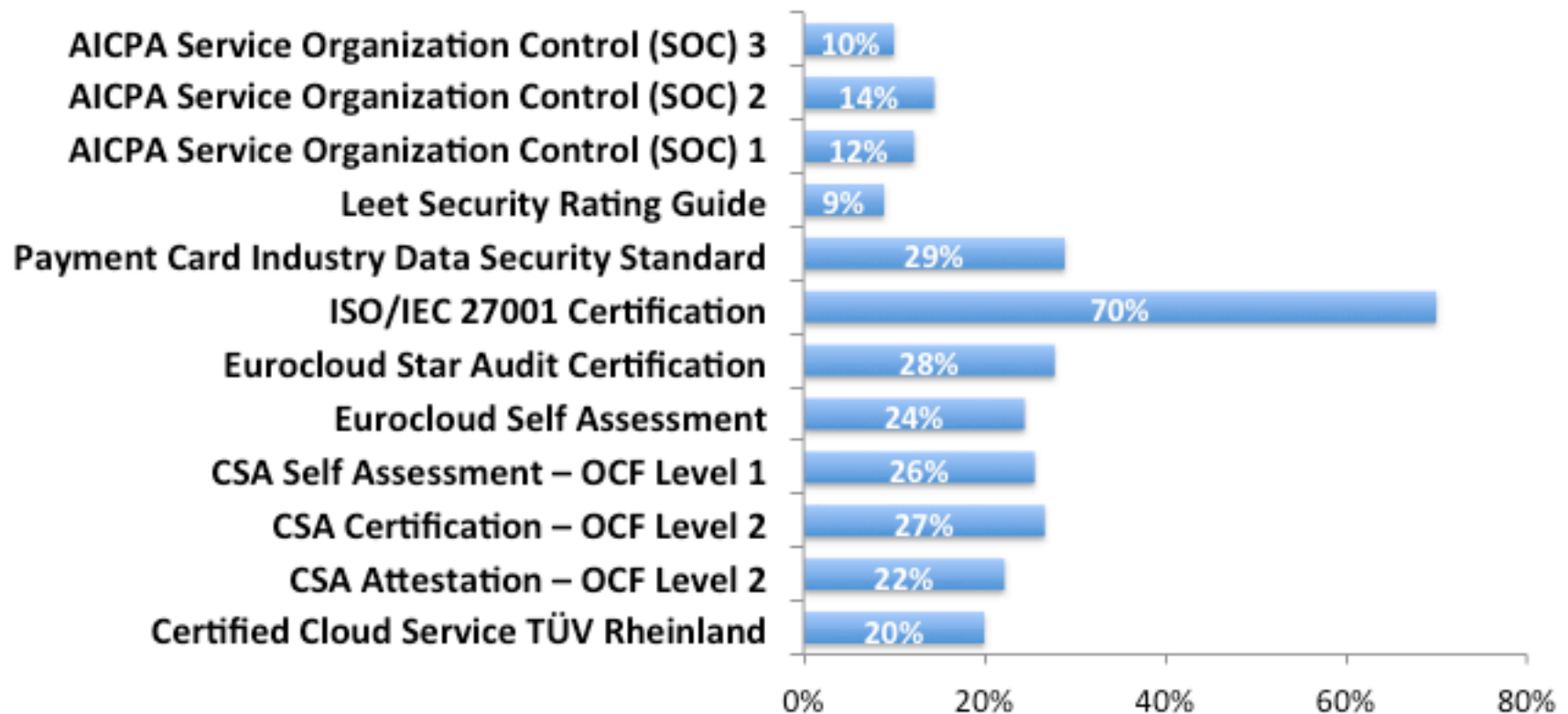


Survey Results

Question 52



Which of the following Cloud Certification Schemes listed in CCSL are you are aware of?



Conclusions and recommendations

- The present report indicates that running a web survey on Cloud standards may **yield relevant findings even though the number of respondents is limited** and the composition of the respondents resulting from the invitation to selected stakeholders is representative of the overall population only to an unknown extent.
- The findings made during the analysis of the survey support the continued strive towards closing the identified gaps in terms of support for Cloud Computing standards. It also shows a growing awareness of the importance of standards, in general and for Cloud Computing in particular.
- Based on the principal areas of concern, illustrated in the above figure, the Cloud Standards Coordination Phase 2 experts have listed some recommendations following the findings in the web survey. These recommendations are:

Collaboration across key Cloud Computing stakeholders

○ Encourage and increase collaborations across

- **the various relevant initiatives in Europe**
- **standards development organizations (formal, de jure and de facto)**

to avoid and minimize fragmentation and overlap in the Cloud Computing related standardization efforts.

○ During the CSC-2, contacts have been made with

- **the US standardization agency, NIST**
- **the EuroCIO organization**

in order to add further value to the CSC-2 results as well as securing awareness of the CSC work.

Dissemination and Marketing

- **Need** to ensure that Cloud Computing stakeholders (users, customers and providers) **are made aware of existing standards and certification programs.**
- The relatively low response and awareness found among the respondents of the web survey strongly suggests that **the importance and potential benefits of standards and certification schemes need to be further advocated and marketed** by using in the relevant channels through the appropriate EU agencies and also by the SDOs.

Conduct the Cloud Web Survey regularly

- Keeping track of the end users perception of Cloud Computing benefits and challenges provides **an excellent backdrop for ongoing as well as future efforts to close the identified gaps** and address the challenges disclosed by the web survey.
- The STF 486 experts see the web survey as a good tool to gauge the progress and state-of-affairs in the Cloud Computing space and **recommend that the web survey is reopened and run on a regular basis, tentatively on an annually basis.**

Security aspects - a key concern

- “Security”, as a concept, is without doubt a major concern for most users, customers and providers alike, in particular in a Cloud setting, as the resources typically are shared and - as a consequence - data integrity confidentiality and availability need additional attention to ensure a retained confidence in the ownership of data.
- Many users are concerned about “losing the control of data”
- Unless Security - all relevant aspects of Security related to Cloud Computing - are fully addressed and the users are made aware of available options and existing protocols and standards that can be used to build reliable Cloud Computing offerings.
- The adoption of Cloud Computing is likely continuing to grow slower than expected.

- The analysis supports the provisioning of certification schemes, where certification of vendors and the cross cutting aspects of
 - **data storage location (one aspect of privacy)**
 - **cloud datacentre infrastructure**
 - **cloud provisioning process and interoperability / reversibility**
 - **Legal / Contractual aspects, SLA**are top priorities.
- **These aspects are general concerns that need to be addressed to accelerate the adoption of Cloud Computing.**
- The CSC-2 results of the web survey are used as input to the other tasks and work items of the CSC

- **The Cloud Standards Coordination Phase2 experts see the standards coordination effort as well funded and highly relevant.**
- **It is recommended that the standards coordination results be thoroughly disseminated and that the industry and Standards Development Organization contacts and collaborations made as part of the Cloud Standards Coordination initiative continue.**

Conclusion

On the road for adoption



○ Users

- Different: expectations, issues, resources, skills, perception
- Common: must-have, must-adapt, must-prepare

○ Adoption

- Most organizations (incl. SMEs) have started the adaptation work
- Security and Privacy & Data integrity are recurrent concerns
- What to do with the legacy IT?

○ Standards

- Much support expected from standards & certification
- More awareness & marketing of existing standards needed
- More coverage: SLA, Security, Privacy & Integrity, Interop
 - → looks a bit like status at the end of 2013



World Class Standards

The WP4 report

Standards Maturity Assessment

○ Main content of the report

- 5 Evolution of the Cloud Computing standards landscape
 - 5.1 Customers and Users view on Cloud Computing Standards and Certification
 - 5.2 Cloud Computing Standardization and Certification
 - 5.3 Cloud Computing Standards and the Cloud Service life-cycle
- 6 Users concerns: how standards can help
 - 6.1 Comparison of user concerns: how standards can help
 - 6.2 How standards are in support of users' concerns
 - 6.3 Summary
- 7 Conclusions and Recommendations
- Annex A: Cloud Computing Standards Landscape
 - A.1 Presentation of results
 - A.2 SSOs and Standards list
- Annex B: Standards in the CC Service life-cycle

○ List of standards

- There are 114 documents from 16 organizations, 94 with the status “Published”, 14 with the status “Draft” and 6 with the status “In progress”. This is to be compared with the list of CSC phase 1 that included 65 documents from 17 organizations, 50 with the status “Published” and 15 with the status “Draft”.

○ Observations

- The number of SSOs involved is slightly lower than CSC phase 1;
- The overall number of standards is higher than in CSC phase 1, in particular for the “Published” ones. This is showing that the coverage of the standards is larger than during CSC phase 1 (as anticipated);
- This clearly indicates that to some degree a **consolidation of the standardization landscape has taken place since CSC phase 1**.
 - This is both because of a reduced number of actors and of a greater importance of Standards versus White Papers and Reports (which were playing a greater role in CSC phase 1).

○ Top users' concerns

- The three concerns identified in the 2013 report - Service Level Agreements, Interoperability, Security - are still ranked under the top concerns.

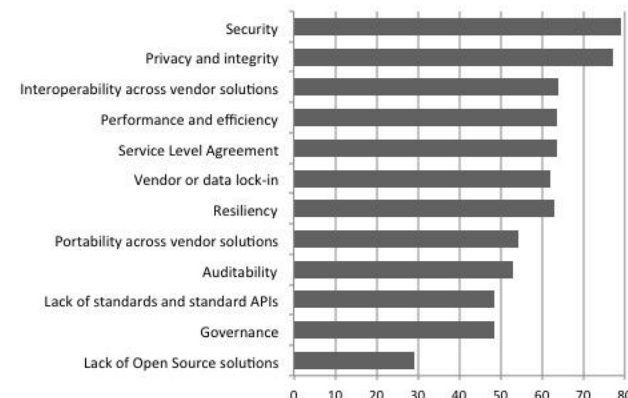
○ Standards

- There are already a number of standards in support of these concerns
- Many of them not Cloud-specific are already used or need to be promoted and adopted
- More are under development, e.g. from ISO/IEC, OGF, NIST

○ Other concerns

- Contract (besides or complementary to the SLA);
- Legal aspect and Legislation;
- Financial health of providers.

As it was the case for CSC-1, the standards and specifications identified in CSC-2 may not be very much supportive.



- There is still work to be done to fully address the main concerns of existing and future Cloud Computing users as presented in the “Users survey” and “Interoperability and Security” reports.
- The web survey shows a growing awareness of already existing standards and certification schemes will most likely favorably change the experience of many users that the Cloud is insufficiently safe and reliable to use for enterprise class ICT (e.g. weak SLAs, insufficient recovery/fallback provisions for disasters in the past, data theft by, e.g., national intelligence agencies, industrial espionage).
- The analysis of the available standards that target the Cloud in the main areas of users’ concern show that efforts are underway to at least partially address some of the major concerns.
- Examples of significant ongoing developments include the work done in ISO/IEC where three parallel development projects are underway – on Cloud SLA, interoperability and portability, security, and finally on data.

WP4 Report

Recommendations (1)



- Encourage the development of of education and dissemination material of Cloud Computing standards (across all concerned SSOs);
- Encourage the large SDOs/SSOs to strengthen collaboration and cooperation, ... thus supporting the EC's objective to make the Cloud available and secure for the EU member states' citizens, public sector and private sector alike;
- Encourage SSOs and Open Source organizations to more systematically provide formally documented support for Cloud Computing standards;
- Regularly organize “progress report” events to advertise the progress made ... towards the Cloud Service Customers (e.g. SMEs, industries) thus supporting the EC's objective to make the Cloud available and secure for the EU member states' citizens, public sector and private sector alike.

- As part of the progress report events the adoption of each appropriate standard or specification should be evaluated to provide an indication for the changes in the use of standards and specifications, e.g., increased or decreased use respectively;
- There are many interoperability and portability standards and specifications that are supported by Cloud providers that are not Cloud-specific. Identifying and publishing a core set of these across Cloud providers would be helpful during the provider selection phase;
- Gaps identified in this report (marked in the tables in section 6.3.0 – 6.3.3) need further analysis to identify the relevance of each gap, e.g. which gaps are blocking and need to be addressed with priority.
- Further analysis is needed to decide whether intervention by the EC is needed to organize the effort to close the gaps with a high priority or the respective communities will take care of and/or the market will drive the effort for closing the gaps.

- Special attention should be given to the creation of standards and specifications for detailed monitoring of the CSP services to enable efficient and informative reporting towards their CSCs and to enable the CSCs to retrieve information needed to monitor the fulfillment of their SLAs and to take proactive actions in case of degradation of one or more relevant metrics;
- Encourage Open Source Projects, probably together with some incentives, to bring their APIs into SSO/SDOs for rendering them into a standard or a specification.

WP4 Report

Some areas for further study



- Updated and more complete list of Cloud Service life-cycle activities in Annex B.
- A more complete mapping of standards on the list of activities, provided it is modified as described above.
- Recommendations regarding the way to support the education and dissemination effort regarding existing and emerging standards.
- Expand the list of standards to relevant non Cloud Computing-specific standards.



The WP1 and WP4 reports Panel Discussion

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Thank you!

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