

Cloud Services Procurement Roadmap for public research organisations



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Executive Summary

Computing in the cloud is providing new efficiencies in a wide range of sectors. During its two-year pilot phase (2012-2014) the Helix Nebula Initiative (HNI) has shown that cloud services are suitable for scientific workloads performed by public research organisations who are now prepared to consider procuring cloud services on a significant scale. In spite of this, however:

- » While technology service options continue to evolve, procurement processes and policies of these organisations have remained firmly rooted in **historical practices that are no longer effective**.
- » In order for public research organisations of all sizes to take advantage of the best solutions that the market has to offer nowadays, **a more flexible and agile procurement process must be created and implemented**.

PICSE, a Coordination and Support Action, was set up to further our understanding of these two procurement-related findings in line with pillar three of the Digital Single Market Strategy. This Roadmap is a major product of the PICSE project. It provides a description of the landscape of cloud procurement in the European public research sector and documents existing challenges, barriers and trends. Based on world-wide procurement best practices it explains how cloud computing is disrupting the way IT resources are provisioned for research communities and provides a way of understanding how to address the HNI findings. In particular, recommendations for improving procurement of cloud services for public research organisations in Europe must address the fact that procurement practices are changing significantly:

- » Procurers need new competences to address the shift from purchasing systems for in-house deployment to negotiating and purchasing services.

- » The supply-side also needs to address changes in the nature of its business, from providing bespoke or turn-key system solutions to managing deployment of the capacity needed to meet variable demand.
- » An environment made up of existing in-house resources, publicly funded e-infrastructure and commercial cloud services does not provide a seamless service.
- » Current organisational and financial models are no longer appropriate and some barriers such as legal constraints are proving difficult to overcome.

This Roadmap for Cloud Service Procurement includes a significant **Call for Action for the three major stakeholder groups** who can be found at regional, national and European levels:

- » **Publicly-funded research organisations** seeking sustainable solutions to its ICT needs.
- » The **suppliers of cloud services**, including major providers of ICT infrastructure and cloud-specialists.
- » **Policy makers** (the regulators and facilitators).

In total, **20 recommendations** are made for immediate action. These address:

- » **Competences and organisational culture.**
- » **Enabling innovation in procurement and services.**
- » **Stimulating the research cloud ecosystem.**
- » **Adopting new business models.**
- » **Validating the benefits.**



Foreword

Smart and dynamic procurement of cloud services

During the past two decades digital life has become truly global and the digitalization has deeply and irreversibly changed the economic and social fabric of society. Information and Communication Technologies and the accompanying data ecosystems remain in full evolution. It is hardly an exaggeration to say that almost every day new, innovative usages appear. The digital world seems to be in a perpetual state of turmoil and although one might expect computing and networking to settle into stable mid-life maturity, new developments continue to change the status quo. Cloud computing is one such enabling development for the digital economy, for science and innovation, for the continued digitalization of industry and government, for smart cities, e-culture and for social networking.

Research and Science has often proven to be at the forefront of wider societal developments, including the digitalization. The very Internet itself came from the interconnection of academic networks, and the World Wide Web came from

hypertext link technology invented for and by science at CERN. It is no surprise that major developments in society arise from endeavours originally motivated by scientific challenges. Hence it is no surprise that science and research are among the most sophisticated and thoughtful explorers of cloud computing, and are comprehensively looking into appropriate ways of procuring cloud services.

We clearly are no longer at the beginning of cloud technology development, however not yet at the end of its maturity cycle. Operational cloud computing technologies are well-known and readily available. What is less known and less established are smart and dynamic ways of procuring these services, to ensure that users reap the benefits and avoid the pitfalls.

We welcome the PICSE Roadmap, which fills a gap and makes a difference; therefore, we invite all stakeholders to use it as a reference in their journey in procuring cloud services.

Dirk van Rooy, Ph.D.

Head of Sector

DG CONNECT, European Commission

1. Scope of the PICSE Roadmap

PICSE¹ (644014, 2014-2016) is a Coordination and Support Action funded by the EU Framework Programme for Research and Innovation Horizon 2020. Over an 18 months period, it set up a European Procurers' Platform capable of raising the level of understanding in issues related to the procurement of cloud services. Based on an initial set of use cases from the science domain, this unique repository of information has supported a network of procurers with tips and recommendations related to cloud procurement and promoted the cloud services market. In addition, it helped all the stakeholders involved in the cloud procurement field to understand the implications of the work going on under the EU cloud computing strategy² and the Digital Single Market³, with particular focus on the European Open Science Cloud⁴.

PICSE arose from the Helix Nebula initiative⁵, of which all three PICSE partners (CERN⁶ as the Coordinator, CSA⁷ & Trust-IT Services⁸) are members. The work achieved by the Helix Nebula initiative during its two-year pilot phase (2011-2012) has shown that cloud services are suitable for scientific workloads performed by public research organisations and these are now prepared to consider procuring cloud services on a significant scale. However, while technology service options continue to evolve, **procurement processes and policies of these organisations have remained firmly**

rooted in historical practices that are no longer effective.

In order for public research organisations of all sizes to take advantage of the best solutions the market has to offer nowadays, **a more flexible and agile procurement process must be created and implemented.**

This Roadmap is a major product of PICSE. In addition to highlighting existing challenges, barriers and trends, it:

- » Provides a landscape of cloud procurement in the European public research sector (Chapter 2).
- » Proposes actions within pillar three of the Digital Single Market Strategy which focus on maximising the growth potential of the digital economy (Chapter 3).
- » Supports these recommendations regarding procurement of cloud services for public research organisations in Europe with case-studies (Chapter 4).
- » Provides a guide to cloud procurement, supported by best practices adopted worldwide (Chapter 5).

In Chapter 3 in particular, the Roadmap represents a precise Call for Action for the three major stakeholders involved in the cloud procurement process at a European, national or regional level: **Public sector research organisations** (the demand-side), **Cloud Service Providers** (the supply-side) and **Policy Makers** (the regulators).

1 www.picse.eu

2 <https://ec.europa.eu/digital-agenda/en/cloud>

3 ec.europa.eu/priorities/digital-single-market_en

4 <https://ec.europa.eu/research/openscience/index.cfm?pg=open-science-cloud>

5 www.helix-nebula.eu

6 The European Organization for Nuclear Research, home.cern

7 The Cloud Security Alliance, cloudsecurityalliance.org

8 Trust-IT Services, www.trust-it-services.com

2. The research public sector cloud procurement landscape

The publicly funded research sector faces unsustainable demand for computing and networking services to deliver the promise of Open Science. Cancer research is a typical example. Over a million estimated genome datasets from cancer patients will become available to the life science community by 2019⁹. This will be a big step forward creating enormous opportunities for cancer research.

However, no single European research centre will be able to provide the necessary infrastructure to analyse the hundreds of thousands of genomes, to store and access them securely or to utilize these data efficiently for translational research and downstream medical application.

Researchers need more cost-effective approaches to collecting, processing, distributing and re-using the rapidly growing amounts of data being produced by scientific instruments.

“The European Open Science Cloud would offer 1.7 million European researchers and 70 million professionals in science and technology a virtual environment with free at the point of use, open and seamless services for storage, management, analysis and re-use of the data that are linked to their research activities, across borders and scientific disciplines.”¹⁰

A European Open Science Cloud represents a strategic vision that can be a vector for introducing change in the service provisioning and computing models for the publicly funded research sector in the medium to long term. It will significantly change the way IT services are procured, organised and funded. In order to achieve this vision a number of challenges need to be addressed which we outline here.

» **Cloud computing is disrupting the way IT resources are provisioned for research communities.** Traditionally the IT departments of research organisations have developed and operated in-house the services that their users required. This situation is now being disrupted with commercial cloud providers offering off-the-shelf innovative services which are in many cases initially made available as a free trial. There are many instances of users by-passing their traditional service provision channels to get these commercial on-demand services. This could be considered as a form of shadow IT where users act independently and may not be aware of existing policy and security boundaries of publicly funded research organisations. This shadow IT innovation represents an opportunity to introduce change but users must be fully educated on policy aspects including data protection, intellectual property rights and applicable legislation.

» **In-house resources, publicly funded e-infrastructure and commercial cloud services are not integrated to provide a seamless environment.** Users should be able to make a more effective use of the in-house resources by integrating them, when needed, with services offered by public and private cloud providers. Today moving data and applications

between multiple cloud service providers is not always easy and often involves high costs associated with a high risk of vendor lock-in.

» **Current organisational and financial models are not appropriate anymore.** With cloud computing, ICT costs become an integral part of the cost of doing science. Procuring ICT services traditionally involved one-off purchases of hardware or software with additional support and maintenance costs. Cloud service models avoid up-front costs in exchange for recurring and often variable service charges. Cloud infrastructure and other ‘as-a-service’ offerings combine many indirect costs into a single service payment based on use and can enable more flexible pricing models such as per core/hour or per request/transaction. This means that there may be a wide range of financial implications that need to be considered especially when comparing traditional on-premises solutions with cloud services. These include energy consumption, resourcing needs, data centre resources, capital costs for infrastructure, software asset maintenance and personnel.

The organisation’s financial procedures and funding arrangements must be able to address the on-demand model, which therefore should be able to support a move of funds from capital expenditures (CapEx)¹¹ to operational expenditure (OpEx)¹². Moving from a CapEx to an OpEx model develops the use of operational expenses rather than capital assets and the treatment of operating statements rather than balance sheet management.

» **The new way of procuring cloud services is also a matter of skills and education.** With no standard framework in place, many organisations do not have skilled or trained staff in place to procure cloud services. This should not be underestimated.

» **Legal impediments exist:** Legal challenges can be divided into two categories: challenges common to most cloud services (e.g. applicable law, jurisdiction & dispute resolution, data protection, liability, contractual framework, data portability, interoperability); and public-sector specific challenges (e.g. public procurement legislation related concerns, etc.)¹³. These challenges result in a series of legal barriers that are mainly related to the fragmented and diverging patchwork of conflicting national laws resulting from local implementation of European legislation, with the European Data protection legislation as an area of focus.

The following section summarizes a set of Calls for Actions needed to overcome some of the barriers introduced earlier, and to speed up the procurement of cloud services on behalf of public research organisations in Europe.

9 Towards the European Open Science Cloud event helix-nebula.eu/events/open-day-event-towards-the-european-open-science-cloud

10 <https://ec.europa.eu/research/openscience/index.cfm?pg=open-science-cloud>

11 CapEx are expenditures creating future benefits, such as acquiring or upgrading assets, www.investopedia.com/terms/c/capitalexpenditure.asp

12 OpEx are ongoing costs related to the production of an organization’s goods or services www.investopedia.com/terms/o/operating_expense.asp

13 D2.1 Legal implications on cloud computing, Cloud for Europe, March 2014, www.cloudforeurope.eu/documents/10179/15444/D2.1+Legal+implications+on+cloud+computing+v1/023da045-4c78-4cd7-afe6-0a5de01c0347

3. Call to Action

The following recommendations constitute a 5-part “Call to Action” for ‘mainstreaming’ cloud-computing in the ERA in line with the European Cloud Initiative which was launched as part of the Digital Single Market (DSM) strategy. Public sector research organisations, cloud services providers and policy makers are the major stakeholders in both of the strands of the initiative: an Open Science Cloud¹⁴ and a Data Infrastructure. These recommendations have been formulated to reduce the ‘cost of entry’ for those stakeholders. They take into account a baseline in terms of the capacities in the marketplace today and the expectations of the key stakeholders consulted during the PICSE project.

Part 1: Competences and organisational culture

Part 2: Enabling innovation in procurement and services

Part 3: Stimulating the research cloud ecosystem

Part 4: Adopting new business models

Part 5: Validating the benefits

These recommendations can be implemented within the timeframe of the DSM strategy, subject to resolution of three constraints identified in the 2012 communication on “Unleashing the Potential of Cloud Computing in Europe”¹⁵: fragmentation, lack of legislative harmonisation and the plethora of standards. Several of the recommendations specifically address these constraints.

3.1 Recommendations

Part 1: Competences and organisational culture

Recommendations for public sector research organisations

1. Build internal competences for cloud procurement and share requirements & best practices

a. Share experiences, best practices & lessons learnt from procurement with other organisations representing both supply and demand. Case studies documented by the PICSE project will be maintained for at least the next three years¹⁶ and could become the reference point for cloud procurement use cases and best practices just as the Joinup library is the reference point for ICT open standards¹⁷. See references to

14 <https://ec.europa.eu/research/openscience/index.cfm?pg=openscience-cloud>

15 COM (2012) 529: eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2012:0529:FIN:EN:PDF

16 www.picse.eu

17 https://joinup.ec.europa.eu/community/open_standards_ict/og_page/best-practices-library

EIFIP as a platform for capacity-building in Recommendation 8. JoinUp has an e-Practice community which should also yield suitable case studies.

b. Move to e-procurement practices from which the EC strategy for e-Procurement (COM(2012) 179 final) indicates expected savings of between 5% and 20%. As part of the DSM strategy, the e-Government Action Plan 2016-2020 also emphasises the importance of e-Procurement yet some public research organisations still require printed documents. This can be easily accommodated for the short term by purchasing through a financial cloud broker, an intermediary without these procurement constraints.

c. Ensure that the organisation understands the benefits of practices such as outcome-based specification and the need for greater flexibility in working with vendors. Revise eligibility (qualifying) criteria for suppliers to reflect commercial cloud practices rather than relying on traditional criteria for purchasing ICT. The role of a ‘cloud broker’ is discussed in Chapter 4.

2. Adopt cloud-specific standards and identify these in procurements

a. Adopt and insist on compliance with standards which improve transparency and comparability for users of services while allowing suppliers to present their unique selling propositions. The CloudWATCH Cloud Standards Guide¹⁸ covers portability, interoperability and security. It states that “*Standardisation is seen as a strong enabler, bringing more confidence to users, especially SMEs. Consumers are increasingly concerned about the lack of control, interoperability and portability, which are central to avoiding vendor lock-in, whether at the technical, service delivery or business level, and want broader choice and greater clarity. Open standards can protect consumers and are one of the most important means used to bring new technologies to the market*”.

b. Apply suitable standards across the entire Cloud Services Lifecycle. ETSI’s cloud standards maturity report¹⁹ provides a framework mapping standards and specifications to the activities across the life cycle of acquisition, operation and termination of cloud services. It identifies twenty areas where suitable material exists in draft or published form, but identifies a further twenty activities where no suitable standards exist. Two sources of further information about cloud-specific and other relevant standards are the NIST Inventory of Standards Relevant to Cloud Computing²⁰, and the Cloud Standards Wiki²¹.

3. Validate and use well-defined standard procurement terminology

a. Work with suppliers to identify and endorse mutually agreed clauses, well-defined terminology, technical standards and metrics, including SLAs and other kinds of performance indicator, that can be used in tender procedures, from the terms used in online catalogues to the legal wording in contract clauses.

18 www.cloudwatchhub.eu/cloud-standards-guide

19 csc.etsi.org/phase2/Snapshot2.html

20 collaborate.nist.gov/twiki-cloud-computing/bin/view/CloudComputing/StandardsInventory

21 cloud-standards.org/

b. In the absence of a single standard cloud framework, refer to EC-funded initiatives that are working to make available standard tools to facilitate the process of procuring cloud services.

- » The PICSE project has developed a web-based application, the PICSE Wizard²², to guide procurers and IT managers through the cloud procurement process and a Guide to Cloud Procurement which is available as an annex of this document.
- » The main objective of the SLALOM project²³ is to create a Service Level Agreement (SLA) reference model consisting of model contractual terms and model technical specifications. It has just released the SLALOM SLA model terms and specifications emerging from the analysis of a set of metrics (Service Level Objectives).
- » The SLA-Ready project²⁴ makes available a comprehensive guide on cloud SLAs across the entire cloud service lifecycle. This will include a set of user-friendly guides based on a common reference model. The common reference model also encourages CSPs to be more transparent and use standard SLOs.
- » The SPECS project²⁵ is helping customers to map their security requirements and monitor performance.
- » Through its hub²⁶, the CloudWATCH2 project makes available for easy consultation a set of tools and guides for public authorities and research organisations. CloudWatch has released a set of use-cases which it calls cloud standard profiles²⁷.

Recommendations for cloud services providers

4. Invest in the end-user facing services and in training next generation of researchers

a. Leverage the investments already made in the public sector and commercial cloud services. Cloud service providers must not simply rely on their customers to invest in end-user facing services and in training the next generation of IT-savvy researchers. Suppliers in the public and commercial sectors must facilitate investment in human capital within customer institutions (see also reference to the role of policy makers, below) as well as the technological building blocks for the development of more advanced cloud services. This will also contribute to acceleration of cloud adoption.

Recommendations for policy makers

5. Educating buyers and consumers on cloud computing

a. Address the skills gap that currently exists²⁸ and which will continue to constrain the potential of the Digital Single Market unless addressed decisively. Organisations with a strong understanding of cloud computing from the technical, legal and procurement perspective are much better prepared for procuring cloud services and have a higher success rate.

The Commission and Member States should continue to

22 wiz.picse.eu/

23 slalom-project.eu/downloads

24 www.sla-ready.eu/

25 www.specs-project.eu/

26 www.cloudwatchhub.eu/

27 www.cloudwatchhub.eu/cloud-standards-profiles

28 European Commission, "Grand Coalition for Digital Jobs", April 2015, available at: <https://ec.europa.eu/digital-agenda/en/grand-coalition-digital-jobs>

work with industry to sponsor increased numbers of training opportunities and skills-based resources, and to promote awareness of inclusive cloud education.

Part 2: Enabling innovation in procurement and services

Recommendations for public sector research organisations

6. Review internal procurement policies and make tenders SME-friendly

- a. Change internal policies that regulate the procurement of cloud services provided by commercial cloud services providers (CSPs) to make procurement more easily accessible to smaller and medium-sized enterprises as well as larger companies through inclusion in online catalogues, straightforward pre-qualification procedures and industry-backed terms of agreement that reduce legal cost. Increased competition leads to better services for the public sector organisation. SMEs are more capable of providing niche services to specific requirements of smaller organisations than large enterprises that aim their services at the whole market.
- b. Create strategic, agile procurement practices with more flexible and less complex procurement strategies. This moves away from 'one-size fits all' tenders and fixed-term panel contracts which lock out suppliers for long periods. There are lessons to be learned from initiatives such as the first Call for Tender for Cloud Services (CLOUD I) for the EC²⁹, which attracted significant interest and generated more than 450 questions asked by potential bidders.

7. Encourage innovation and competition

- a. Strengthen and widen dialogue with the supply-side. Promote the use of forums where public sector research organisations can be made more aware of the latest solutions available on the market while private and public cloud service providers and cloud brokers will become more aware of their customers' needs. Include topical agendas (e.g. business models, standards) as well as briefings for suppliers at an early stage when planning procurements and publicise tenders effectively.
- b. Focus on 'value for money' over 'least cost'. Adopt outcome-based procurement practices to meet business objectives where possible instead of being constrained by traditional practices that rely solely on detailed technical specifications and service-level agreements. Look for good fit commercial off-the-shelf (COTS) services.
- c. Use Pre-Commercial Procurement & Public Procurement of Innovation practices as instruments for innovation.

Recommendations for policy makers

8. Establish a cloud chapter in the European Assistance For Innovation Procurement (EAFIP)³⁰

- a. Consider innovation procurement as an instrument to procure the innovative cloud services needed by public sector organisations. EAFIP promotes the benefits of innovation
- 29 ec.europa.eu/newsroom/informatics/item-detail.cfm?item_id=28799
- 30 eafip.eu/

procurement, providing assistance to public procurers with a concrete interest in implementing innovation procurements of ICT based solutions across the EU. This could be used to train research organisations on the innovation procurement instruments. It could leverage on the knowledge collected and produced for the PICSE platform and it could collect all the lessons learnt and results coming from the Cloud for Europe³¹ and HNSciCloud³² PCP projects. In this way it could become the predominant cloud procurement innovation portal for both public administrations and the research sector.

- b. Capitalise on previous investment by encouraging adoption of project outputs and establish terms and conditions for reuse. Where common and open standards are not yet available, initiatives will run the risk of duplicating development effort unless they are made aware of suitable products and services. Where suitable, these results can be added to the catalogue of cloud services. Initiatives such as the JoinUp European Interoperability Reference Architecture³³ and Connecting Europe Facility³⁴ have identified key assets for re-use.

Part 3: Stimulating the research cloud ecosystem

Recommendations for public sector research organisations

9. Engage the industry and manage relationships with multiple suppliers

- a. Use an appropriate vehicle to engage with suppliers, both from the private and public sectors. Participants should be committed to develop a shared vision and a shared action plan. The Helix Nebula Initiative (HNI)³⁵ is a forum with a well-defined governance model³⁶ that is open, transparent and supported by both private and public entities. This allows rapid responses to changing circumstances when necessary, less common in the public sector than among their suppliers. It provides a range of activities to establish an open standards-based ICT service marketplace serving, initially, the publicly funded research sector and related industries. Public research organisations and service providers from the public and private sectors can join HNI free of charge³⁷.

10. Adopt standards to improve the quality, security and sustainability of products and services

- a. Enable interoperability between services, portability from one provider to another and trust in the integrity (provenance, reliability, etc.) of the services on the part of their users. The adoption of open standards such as Topology and Orchestration Services for Applications (TOSCA³⁸) can alleviate concerns about vendor lock-in and allow users to move data and applications between multiple cloud service

31 www.cloudforeurope.eu

32 www.hnscicloud.eu

33 <https://joinup.ec.europa.eu/asset/eia/description>

34 https://joinup.ec.europa.eu/community/cef/og_page/catalogue-building-blocks

35 www.helix-nebula.eu

36 www.helix-nebula.eu/sites/default/files/files/HNI%20Governance%20Model_2015.pdf

37 www.helix-nebula.eu/become-new-member

38 www.cloudwatchhub.eu/cloud-standards-guide

providers at low cost and with minimal disruption.

Recommendations for cloud services providers

11. Engage with demand side to understand the needs of the market.

- a. Participate in an open forum where cloud service providers and cloud brokers can collectively develop a clearer insight into demand-side needs. As mentioned above, HNI represents a good forum where public and private Cloud Service Providers (CSPs) can meet users and, significantly, each other (see recommendation 12, below).

12. Create a working economy between suppliers rather than always competing

- a. Establish a dialogue with other suppliers for a common understanding of what is meant by 'the cloud'; what is expected, roles and responsibilities, and interoperability between different solutions. This will stimulate the market for services, with better customer alignment and will create a truly harmonious ecosystem that will expand the size of markets in which cloud providers operate, with customers who are secure in the knowledge that they can change providers, or use multiple providers, without significant technical challenges or effort. Currently the Helix Nebula Marketplace (HNX)³⁹ is trying to set up such cloud provider ecosystem.

Recommendations for policy makers

13. Create a unique European catalogue of cloud service providers and related services for science

- a. Establish an inventory of European cloud service providers which can be developed and maintained by and for the research stakeholder community. Procurers need to find the best solutions available on the market that fit with their requirements and to compare offers and pricing of different providers. Public research organisations commit significant time and resources to intensive market research analysis because there is no unique reference database of European cloud service providers and their offerings. This has prompted GÉANT to build a cloud service catalogue⁴⁰, one of the functions of which is to act as a repository of questions and answers. All cloud providers are invited to include their cloud services in the catalogue, in order to present these to the research and education community. The basis for this online directory is a coordinated list of pan-European core requirements that cloud service providers are expected to meet.

- b. We recommend that this action be incorporated in the European Open Science Cloud strategy. Establishing shared eligibility criteria for the suppliers that could become part of the catalogue can improve standardisation and increase trust from the research sector. Make sure that providers are correctly classified on the basis of the services that they provide, the certifications that they have, and the geographical coverage of their offer. A shared catalogue should replace the typical eligible supplier database that procurement offices in every single research organisation currently commit significant resources to maintaining and keeping accurate. A number of cloud provider catalogues

39 hnx.helix-nebula.eu/

40 <https://catalogue.clouds.geant.net/#/>

exist, such as Cloud 28+⁴¹, that can provide inspiration.

Part 4: Adopting new business models

Recommendations for public sector research organisations

14. Implement pay-per-use procedures

a. Introduce the possibility to allocate fractions of research grants to the use of cloud computing. This can facilitate and speed up the adoption of cloud computing especially for small medium research sector organisations that do not have the resources and the competences to afford huge procurement actions. Chapter 4 includes a case study of 'cloud credits'.

Recommendations for cloud services providers

15. Establish transparent cloud pricing within clear and publicly available service descriptions

a. The cloud computing market currently lacks transparency and service providers should avoid making it unnecessarily difficult to compare 'like with like' in the way that public utilities use a combination of standing charges and per-use charges. Make it easier for customers to benchmark the suitability of a proposed solution and encourage suppliers to use agreed terminology to facilitate that (see Recommendation 3) especially where the service will evolve over time.

Recommendations for policy makers

16. Enable construction of a bottom-up federated cloud for basic cloud services

- a. Take a bottom-up approach to building a federated hybrid cloud, essential to get the core technical, financial, and policy principles right. Start with commodity services and a federated identity management system offering a single sign-on facility to access common services across all suppliers. The eIDAS Regulation⁴² provides a predictable regulatory environment for eID and electronic trust fully respecting privacy and data protection rules while ensuring that seamless electronic trust services across borders have the same legal value as paper-based processes.
- b. IaaS can be introduced without impacting higher-level user-facing services that will require a significant software investment. It also represents a strategy with lower risk because the IaaS market is more mature than the PaaS and SaaS markets. As outlined in the EIROforum open science cloud paper⁴³, "a European Open Science Cloud should take a bottom-up approach to implementation, starting with IaaS. It should also be founded on a bedrock of federated IaaS vendors, choosing the interface for maximum interoperability."

Part 5: Validating the benefits

Recommendations for public sector research organisations

17. Experiment in the cloud through free trials and small pilots

a. Use small cloud pilots to test various cloud providers and service models in order to understand what can be achieved and what real benefits and real costs are involved. Document this experience in readily accessible Case Studies covering a broad spectrum of best practices and use cases.

Recommendations for cloud services providers

18. Offer free, standalone tests

a. Allow prospective buyers to verify the suitability of the services they need by helping them to create Proof of Concept trials with minimal or no contractual obligations, costs or risks.

Recommendations for policy makers

19. Pilot a federated IaaS cloud ecosystem

a. Build on the existing and planned e-infrastructures and integrate these with commercial cloud services in order to deploy a pilot federated European Open Science Cloud that spans a critical mass of existing research infrastructures and scientific clouds. Use the INFRADEV-04-2016 call which is clearly focused on such a pilot.

20. Establish calls for joint procurement actions focused on SaaS and PaaS services.

a. The HNSciCloud Pre-Commercial Procurement (PCP) project⁴⁴ provides a vehicle for joint investment in IaaS services and a similar approach should be envisaged for higher-level software services. In order for the research community across Europe to be able to benefit fully from the existence of a European Open Science Cloud, it has to expand beyond the basic IaaS level and provide services that are closer to the needs of the daily work of a researcher. The natural follow-on step for successful PCP projects is to procure at a larger scale with Public Procurement of Innovation (PPI) co-funded projects that could significantly increase the capacity and impact of the resulting cloud based platform. A case study on PCP is included in Chapter 4.

41 cloud28plus.eu

42 certifiedsignature.eu/

43 dx.doi.org/10.5281/zenodo.34264

44 www.hnscicloud.eu

3.2 Longer-term harmonisation

One barrier stands apart in the Digital Single Market strategy which is the urgent need for harmonisation of regulations across the Member States, especially in terms of public procurement and data protection. These are structural constraints that will inhibit cross-border procurement and information flows. Clarification of roles and responsibilities such as data-controller and data-processor is required in order to fulfil some of our recommendations in this Call to Action and an advisory mechanism is required in order to clarify the exposure to risk that will apply until harmonisation is achieved.

A unique framework for cross-border procurement.

Different countries have different procurement regulations that can inhibit cross-border procurement. The longer this situation persists, the slower the public research sector take up of cloud computing will be. We advocate the establishment of a single European cloud procurement framework for the public research sector, with an agency, based perhaps on the experience of the UK G-Cloud (Digital Marketplace)⁴⁵

as presented in Chapter 4, providing a cross-border cloud procurement mechanism similar to the way that PICSE did for consortia for the last ICT procurement calls (ICT8).

The cloud procurement agency would declare joint procurements it is willing to coordinate, collect interest from public procurers and, if there is critical mass, launch the tender. In the case of innovative services, procurement can potentially take the form of a PCP/PPI with EC backing. The applicable national legislation would be one of the parameters to take into account when selecting the cloud procurement agency.

Harmonisation and simplification of public procurement & data protection rules.

Draft regulation addresses some concerns but needs to be followed by cloud-specific guidelines for use in the public sector. Attention needs to be paid, in particular, to the way that roles like data controller and data processor are defined, since these often do not correspond to the reality of a cloud environment. EC-funded initiatives such as SLA-Ready and CloudWATCH2 have built up legal expertise in Europe and can provide some guidelines on a freemium basis (where core material is provided free and a charge is made for added-value services).

⁴⁵ <https://www.digitalmarketplace.service.gov.uk/>

4. Innovative cloud procurement for the public sector

In this section we present four case studies of innovative aspects of cloud procurement in the public sector. These inform thinking about many of the issues raised in the previous section and which will give European public sector research organisations greater confidence to 'procure cloud'. The first two help simplify the procurement process, while the other two are examples of innovative business models for different phases in the procurement life-cycle. Collectively, these provide much of the framework needed to establish a central procurement agency suitable for the public sector research sector. Such an agency would benefit both the procurers (by sharing risks) and the suppliers (by aggregating demand)

- » G-Cloud is an example of an online catalogue of cloud services available through framework agreements.
- » Cloud Service Brokers potentially reduce the complexity for customers procuring production services.
- » The NIH Cloud Credits is a way of funding the operation/consumption of those services for the Commons.
- » Joint pre-commercial procurement (PCP) addresses co-funding for innovation through initiatives like the EC's use of PCP.

4.1 Procuring cloud through an agile framework: the G-Cloud example

The UK's G-Cloud⁴⁶ is the seventh iteration of a collection of framework agreements that allows UK government departments and public sector organisations to buy off-the-shelf, pay-as-you-go cloud solutions from a list of pre-approved vendors through an online store (the **Digital Marketplace**⁴⁷) without needing to run a full tender or competitive procurement process; No OJEU (Official Journal of the European Union), Invitation to Tender (ITT), Request for price (RFP), request for quote (RFQ), request for information (RFI) or negotiation necessary.

This approach has brought agile, iterative techniques into procurement with regular refreshes and updates and a maximum contract duration of 24 months. A new iteration of the G-Cloud framework is released about every 6-9 months. This allows the regular inclusion of new suppliers who are OJEU (Official Journal of the European Union) compliant. The G-Cloud aims to promote transparency and make it easy to introduce new suppliers to the UK public sector market which can compare all supplier products and companies listed side by side in an on-screen catalogue. The catalogue showcases supplier's service information, including service definitions, pricing and supplier's terms and conditions.

⁴⁶ <https://www.gov.uk/digital-marketplace>

⁴⁷ Previously "CloudStore" <https://www.gov.uk/how-to-use-cloudstore>

As of January 2016 G-Cloud provides access to over 21,000 services. It has achieved cumulative sales of £1bn (€1.3bn) of commoditised cloud based services predominantly SaaS, some 75% to central government, and more than half coming from SMEs. Potential suppliers can apply to sell services when a new version of a framework is published on the OJEU. On average, an OJEU will be open for 6 weeks, every 6 to 9 months. The information required includes a short service description, key product features and benefits and pricing details which remain fixed for the duration of the iteration.

Suppliers using G-Cloud do not need to be based in the UK to apply, but need to agree to the terms of the framework agreement and call-off contract, which are governed by the law of England and Wales. Scaling up this approach for use across the EU requires harmonisation of those agreements.

4.2 Procuring cloud via cloud brokers

An evident barrier for procurement of cloud services is the contrast between outdated procurement practices and emerging standard practices in the business world. Cloud Service Brokers (CSB) act as an intermediary and aggregator of services provided by different cloud service providers and can reduce this barrier.

- » An independent perspective can be a real benefit to a project, therefore a brokerage should be wholly independent of the cloud service providers so the end customer can be assured the solution and commercial aspects are fit for purpose.
- » In the cloud procurement landscape section we mentioned the need for skills and education. Procuring cloud services via a broker should reduce the need for training and educating internal staff working on the demand side.
- » A brokerage should be supplying cloud buying and analysis skills on a fractional basis, saving the end customer time and money.

A recent (January 2016) call for tender was jointly launched by twenty EU agencies⁴⁸ which shared the same needs and expectations in the cloud service market. In order to optimise the use of EU public funds, the agencies (with the European Food Safety Authority acting as Lead Authority) pooled resources and launched a call for tenders as an interagency joint procurement estimated to be worth €65m over 7 years. The call will establish the framework for a supply channel for multiple types of multi-sourced cloud services in order to:

- » Aggregate the demands across the different participating EU agencies.
- » Act for EU agencies as a single point of contact and management of multiple cloud service providers.
- » Ensure a vendor-neutral framework and create a level

⁴⁸ www.efsa.europa.eu/en/tenders/tender/ocefsaptt201501

playing field for the cloud providers to offer and compare their cloud offerings.

- » Provide integrated brokerage negotiation (e.g. contracts, terms and conditions, SLA, security and data protection clauses) and service delivery with leading cloud service providers operating in Europe.

The goal is to provide a self-service Cloud Management Platform (CMP) to:

- » Present, purchase, provision, monitor and manage cloud resources.
- » Provide a centralised, transparent and uniform billing and invoicing of the consumed services.
- » Ensure flexibility and scalability, including the possibility to charge cloud resources according to the “pay-per-use” model.
- » Ensure compliance with security, data protection and audit requirements.
- » Ensure portability and interoperability among the different cloud providers.
- » Provide complementary, cloud specialised value-added services, such as connectivity services, extended managed services, virtual desktop services, backup services, disaster recovery services, cloud consultancy services and channel catalogue services.

This tender is complementary to the first Call for Tender for Cloud Services (CLOUD I⁴⁹) awarded by DG DIGIT in February 2016. This is a four-year €34m procurement in three ‘lots’ (public and private IaaS and public PaaS) as part of the EC’s move towards cloud solutions for providing internal services.

4.3 The Cloud Credits business model

The Digital Library of the Commons defines ‘commons’ as “a general term for shared resources in which each stakeholder has an equal interest”⁵⁰. The idea behind the Commons cloud credits business model is to provide unified access to a choice of “Commons-conformant” compute resources. This cloud credits model will offer individual investigators a choice of cloud providers so that the investigators themselves can select the best value for their individual research needs.

Cloud computing is increasingly being used as a computing platform by researchers because it affords a high degree of scalability and flexibility in both cost and configuration of compute services. Making public data, especially large commonly used data sets, easily accessible in the cloud will reduce the burden of cost for storing, moving and processing these data sets.

The U.S. National Health Institute (NIH), the U.S. biomedical research agency, has identified the need for a cloud-based commons or digital ecosystem that supports open science⁵¹. It is currently embarked on a three year pilot to test the efficacy of a business model in enhancing data sharing and reducing costs to support the use of cloud computing for the Commons, the

Cloud Credits Pilot. In this model, the participating researchers obtain ‘Commons credits’, dollar-denominated vouchers that can be used with the cloud provider of the investigator’s choice. The involvement of multiple cloud providers will empower investigators by creating a competitive marketplace where researchers are incentivised to use their credits efficiently and cloud providers are incentivised to provide better services at the lowest possible price.

In the pilot NIH would not directly distribute credits; rather, it will contract with a third party to manage the requests for and distribution of credits (shown as the ‘Reseller’ in the cloud credits business model, Figure 1, below).

In order to participate in the Commons, a cloud provider must make its computing environment ‘conformant’, ensuring that it meets a set of standards for capacity (storage, compute, and network) and capabilities that enable scientists to work in such an environment. One potential down-side of this innovative pay as you go model is persistence i.e. digital objects may no longer remain in the Commons if the research agency does not continue to pay for their maintenance. In addition, investigators have an unprecedented level of control over what lives (or dies) in the Commons.

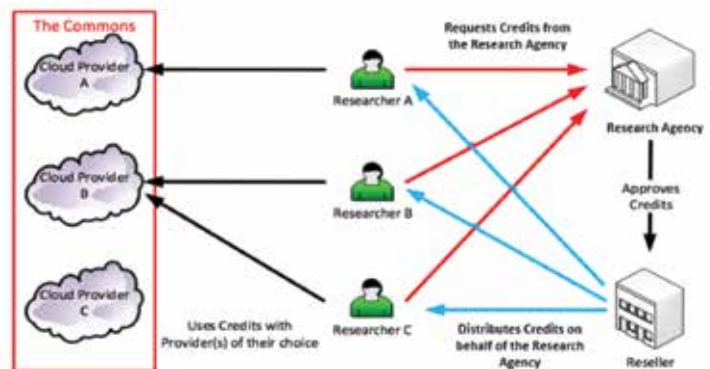


Figure 1: Commons Cloud Credits Business Model

4.4 Procuring cloud via PCP

With government ministries from five European countries involved⁵², Cloud for Europe⁵³ (C4E) sees collaboration between public authorities and industry to provide a streamlined cloud service procurement process. This lowers the Total Cost of Ownership, fixes financial costs, and importantly, shortens the procurement and the service provisioning process as well as the purchase of non-existing services.

Joint pre-commercial procurement (PCP) was identified by C4E as the best way to procure cloud services for the public sector organisations who shared similar needs for innovative services. Following intensive consultation with industry, C4E published its tender⁵⁴ which ran December 2014 to March 2015 with a total budget of €4 million. A total of 29 service

52 The Agency for Digital Italy (Italy), the Ministry of Finance and Directorate General for Tax Administration (the Netherlands), the Ministry for public administration (Portugal), the National Institute for Research & Development in Informatics - Ministry for Information Society (Romania) and the Ministry of Finance (Slovakia)

53 www.cloudforeurope.eu

54 ted.europa.eu/udl?uri=TED:NOTICE:424518-2014:TEXT:EN:HTML&src=0, www.agid.gov.it/cloudforeurope

49 ec.europa.eu/newsroom/informatics/item-detail.cfm?item_id=28799

50 dlc.dlib.indiana.edu/dlc/contentguidelines

51 <https://datascience.nih.gov/commons>

providers from 11 countries⁵⁵ submitted bids including 45% SMEs, 24% large companies and 31% public research bodies. The first implementation phase of the pre-commercial procurement is now going on.

As can be seen from the numbers above, the tender results met the original expectations of the buyers by convincing procurers that Pre-Commercial Procurement is a suitable approach to procure R&D in the cloud.

PCP enables procurers to:

- » Share the risks and benefits of designing, prototyping and testing a limited volume of new products and services with the suppliers, without involving state aid.
- » Create the optimum conditions for wide commercialisation and take-up of R&D results through standardisation and/or publication.
- » Pool the efforts of several procurers.

However, as joint PCP is a relatively new instrument for procurement number there are lots of lessons learnt that can be useful for organisations starting this approach that can be found in the PICSE Report "Procuring Cloud Services Today"⁵⁶.

⁵⁵ Italy, Austria, Estonia, France, Germany, the Netherlands, Romania, Slovakia, Spain, Switzerland, and the United Kingdom

⁵⁶ picse.eu/publications/deliverables/procuring-cloud-services-today-report-experiences-and-lessons-learned

5. Guide to Cloud Procurement

Public sector organisations are a large consumer of ICT, and their procurement power can have significant influence on innovation and competitiveness in the ICT market. The procurement of ICT by public organisations also represents a significant source of expenditure in public funds.

It is therefore paramount that public research organisations know how to procure ICT efficiently and responsibly, promoting competition and innovation in the ICT industry and making the best use of public funds.

This section provides a recap of a set of concrete guidelines for public research organisations on how to procure cloud services that can be found in Annex 1 of this document “Guide to Cloud Procurement”.

Guide to Cloud Procurement

- » Make sure you are procuring what you need.
- » Identify the most suitable cloud service model for your needs
- » Identify the most suitable cloud deployment model for your needs.
- » Make sure to have the appropriate skills.
- » Make sure that the cloud procurement is aligned with the existing procurement policies of the organization.
- » Choose joint procurement to benefit of economies of scale.
- » Choose Pre-Commercial Procurement (PCP) or Public Procurement of Innovation if you are procuring innovative cloud services.
- » Identify clear requirements.
- » Consider the need for a pilot phase.
- » Carry out pre-procurement market consultation & engagement.
- » Select the most suitable procurement procedure.
- » Write an effective cloud tender.
- » Define objective eligibility criteria for Cloud Service Providers.
- » Publish the call for tender & invite suppliers to submit their offers in an effective way.
- » Assess cloud offers looking at Terms of Service.
- » Put in place appropriate terms of service, performance and billing management/monitoring procedures.
- » Assess cloud offers looking at Terms of Service.
- » Write up case studies of procurement exercises to share best practice.

6. PICSE Wizard: Cloud procurement made easy

Are you a procurement official, IT manager or procurement initiator operating in a public research organisation? The easy-to-use PICSE Wizard can help you make informed decisions about how to procure cloud services.

The PICSE Wizard (wiz.picse.eu) is a web-based application designed to support public research organisations in choosing the most suitable model for procuring cloud services. The tool will also help you do a self-assessment of your current procurement process and provide you with a clear set of guidelines on how to improve it.

Use the PICSE Wizard to:

- » Find the best cloud procurement model for you: By simply answering 8 questions, the PICSE wizard will help you identify which cloud service procurement model is most suitable for you, regardless of it being a pre-commercial, commercial or public procurement of innovation.
- » Assess the suitability of your current procurement process: Use the tool to identify gaps and ways to improve the cloud procurement process of your organisation.

Try it now wiz.picse.eu!



Procurement Innovation for Cloud Services in Europe

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Related documents

» D3.1 Procurement Barriers Report:

<https://zenodo.org/record/18309>

» Procuring Cloud Services Today:

<https://zenodo.org/record/48629>

» D3.2 Procurement Best Practices Report:

<https://zenodo.org/record/46545>

» Annex 1 Guide to Cloud Procurement:

<https://zenodo.org/record/49744>



Annex 1: Guide to Cloud Procurement

Introduction

This document is not simply a 'how to' guide. Rather, its purpose is to **act as a checklist for all those involved in procurement of cloud services** including problem-owners (customers), operational staff, contract advisors and solutions providers (suppliers) to establish the extent to which their procurement practices are fit for cloud procurement. Much of the content of this checklist will be familiar to many of its readers. That is to be seen as a good thing. The next step is to consider why and how to address the concepts that are not familiar.

Identify the most suitable cloud service model for your needs

Cloud services are provided according to three different service models. NIST, the National Institute of Standards and Technology, in its special publication 800-145, "The NIST definition of Cloud Computing"¹ defines the cloud service models as follows:

IaaS (Infrastructure as a Service)

The capability provided to the consumer is to provision processing, storage, networks, and other fundamental computing resources where the consumer is able to deploy and run arbitrary software, which can include operating systems and applications. The consumer does not manage or control the underlying cloud infrastructure but has control over operating systems, storage, and deployed applications; and possibly limited control of select networking components (e.g., host firewalls)².

PaaS (Platform as a Service)

The capability provided to the consumer is to deploy onto the cloud infrastructure consumer-created or acquired applications created using programming languages, libraries, services, and tools supported by the provider. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, or storage, but has control over the deployed applications and possibly configuration settings for the application-hosting environment.

SaaS (Software as a Service)

The capability provided to the consumer is to use the provider's applications running on a cloud infrastructure. The

applications are accessible from various client devices through either a thin client interface, such as a web browser (e.g., web-based email), or a program interface. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, storage, or even individual application capabilities, with the possible exception of limited user-specific application configuration settings³.

Practices that have worked for many years when buying conventional ICT applications and platforms may not work for commodity-level cloud services. Concepts like "value for money" or "best value" exist in the public sector as well as for private companies but there are additional considerations for public bodies in terms of their significant influence on innovation, competitiveness and social issues.

As highlighted in our four case studies in Chapter 4 of the PISCE Procurement Roadmap, there are various ways of meeting procurement requirements such as transparency and avoidance of 'lock-in'. And, of course, what works in one jurisdiction may not currently be possible under another. Many of these issues can be explored through the CloudWatch Hub⁴ and there is a comprehensive set of guidelines from the Cloud Select Industry Group working party from the Safe And Fair⁵ initiative. These guidelines are designed to help reassure cloud users that the Service Level Agreement (SLA) and the contract with the cloud provider meet key requirements, including:

- » The availability and reliability of the cloud service being purchased.
- » The quality of support services they receive from their cloud provider.
- » What happens to their data when they terminate their contract.
- » The security levels they need for their data.
- » How to better manage the data they keep in the cloud. The service models do not all work the same way. As a result, although the Terms and Conditions for the three service models share many common clauses, those dealing with operational responsibilities vary. An SaaS service provider is responsible for data protection and encryption of data at rest whereas a PaaS provider is not (applications and data are still the responsibility of the customer, as shown in green in Figure 1).

The IaaS service provider is essentially leasing the infrastructure to the public organisation, requiring the public organisation to be responsible for its own data protection, encryption and reporting. Clauses dealing with compliance to application accessibility standards and those requiring Web services are simply not applicable to IaaS contracts.

Because SaaS providers are responsible for their customers' data, special conditions for termination and suspension of service have to be defined, which is not the case with PaaS

1 <http://csrc.nist.gov/publications/nistpubs/800-145/SP800-145.pdf>

2 Cloud providers typically bill IaaS services on a utility computing basis: cost reflects the amount of resources allocated and consumed.

3 The pricing model for SaaS applications is typically a monthly or yearly flat fee per user, so price is scalable and adjustable if users are added or removed at any point.

4 <http://cloudwatchhub.eu>

5 http://ec.europa.eu/information_society/newsroom/cf/dae/document.cfm?action=display&doc_id=6138

	Traditional IT	Infrastructure (as a Service)	Platform (as a Service)	Software (as a Service)	
Customer responsible	Applications	Applications	Applications	Applications	Service provider responsible
	Data	Data	Data	Data	
	Runtime	Runtime	Runtime	Runtime	
	Middleware	Middleware	Middleware	Middleware	
	Operating system	Operating system	Operating system	Operating system	
	Virtualisation	Virtualisation	Virtualisation	Virtualisation	
	Servers	Servers	Servers	Servers	
	Storage	Storage	Storage	Storage	
	Networking	Networking	Networking	Networking	

Figure 1: Public Sector Management of XaaS Platforms (after IDC).

and IaaS contracts. SaaS contracts specifically require a service provider to maintain data for up to 10 days after a contract expires in accordance with the termination timelines.

The latest trends see the rise of a fourth model, **ICT-as-a-Service**. Nearly anything that you would use a traditional computer for – such as e-mail, web browsing or word processing – will be done via the cloud at a (theoretically) lower cost and with increased reliability and productivity.

Understanding cloud procurement issues

The guidelines in this document are presented as follows:

- » Understand the purpose of your procurement.
- » Make sure that the procurement process complies with public sector and in-house policies.
- » Identify the most suitable cloud deployment model for your needs.
- » Make sure you can evaluate the implications of the choice of cloud service.
- » Carry out pre-procurement market consultation & engagement.
- » Choose joint procurement to benefit from economies of scale.
- » Write an effective cloud tender.
- » Consider the need for a pilot phase.
- » Define objective eligibility criteria for Cloud Service Providers.
- » Identify technical requirements clearly.
- » Identify legal requirements clearly.
- » Identify commercial requirements clearly.
- » Assess cloud-specific Terms of Service carefully.
- » Select the most suitable procurement procedure.
- » Choose innovation partnerships if you are procuring new cloud services.
- » Write up case studies of procurement exercises to share best practice.

Understand the purpose of your procurement

What is driving your procurement? It may be cost-reduction or the need to replace capital expenditure with payment from the operational budget. It may be a capacity issue with the need to respond rapidly to variable, but predictable, levels of demand. Or it may be part of the process of flattening the organisation – replacing specialist operations (such as ingest of data for preservation) with end-user workflows using cloud-based services that can be acquired by an individual researcher. In some cases, the procurement exercise is a flagship for a whole new way of thinking, such as the various ‘open science’ pilots that are taking place with the support of H2020 or equivalent programmes. In others, the primary issue is the inherent flexibility of a cloud-based solution. Failure to acknowledge this flexibility means that you are procuring little more than just another ‘managed service’ bound by traditional SLAs.

Make sure that the procurement process complies with public sector and in-house policies

Public sector procurement is often seen as an agent for innovation and competitiveness and as a way of addressing social issues. The public sector is also subject to EU Public Procurement Directives for the advertising and the award of Contracts if the value of the contract is above a recently revised threshold (€135k for central government bodies, €209k for other public sector contracting authorities). This does not apply to commercial entities although the transparency of procurement processes afforded by the Directives is often seen as best practice in the private sector too.

Eligibility for access to European Structural Funds may also have to be considered, since capital projects funded by ERDF have to comply with different rules to revenue projects under either ERDF or ESF.

Most if not all public sector bodies have some way of allocating budget between capital and revenue costs and ways of ensuring that costs allocated to those budget allocations are (a) actual, (b) necessary and (c) appropriate. The various funding schemes operated by the EC are good examples. One significant aspect of procuring for the cloud is that the customer is no longer purchasing hardware, software or anything else which has an upfront cost. With cloud you are procuring services.

The PICSE Wizard (wiz.picse.eu) is a web-based application

designed to support public research organisations in choosing the most suitable model for procuring cloud services. The tool will help you do a self-assessment of your current procurement process and provide you with a clear set of guidelines on how to improve it.

Identify the most suitable cloud deployment model for your needs

The number of users and their location can influence the cloud deployment model and the legal aspects to be considered in a Service Level Agreement (SLA) with the vendor. Each deployment model differs in terms of who has access to information and resources. There is a summary of key differences in Figure 2 below

- » **Private cloud.** The cloud infrastructure is provisioned for exclusive use by a single organisation comprising multiple consumers (e.g., business units). It may be owned, managed, and operated by the organisation, a third party, or some combination of them, and it may exist on or off premises.
- » **Community cloud.** The cloud infrastructure is provisioned for exclusive use by a specific community of consumers from organisations that have shared concerns (e.g., mission, security requirements, policy, and compliance considerations). It may be owned, managed, and operated by one or more of the organisations in the community, a third party, or some combination of them, and it may exist on or off premises.
- » **Public cloud.** The cloud infrastructure is provisioned for open use by the general public. It may be owned, managed, and operated by a business, academic, or government organisation, or some combination of them. It exists on the premises of the cloud provider.
- » **Hybrid cloud.** The cloud infrastructure is a composition of two or more distinct cloud infrastructures (private, community, or public) that remain unique entities, but are bound together by standardized or proprietary technology that enables data and application portability (e.g., cloud bursting for load balancing between clouds).

Make sure you can evaluate the implications of the choice of cloud service

Traditional procurement of ICT services consists of a pipeline of events, starting with definition of technical specifications (or of business requirements) by the IT manager responsible, typically the budget-holder. There is then a decision of whether to “build or buy”, either building the solution in-house or going outside of the organisation by commissioning a bespoke application or acquiring a COTS (Commercial off the Shelf) solution. Pre-procurement market engagement can allow an open discussion of ways of ensuring market value, prior to procurement engagement.

The procurement office is responsible for the process of collecting documentation for ‘going to market’ if an out-of-house route is followed. This includes assembling the contract and terms and conditions, for which legal expertise is also required. This is followed by engaging the market, typically working from an in-house ‘approved suppliers list’ or (increasingly) from an online catalogue. Finally, the successful bidder (if one exists) is selected, typically from a shortlist of some predefined minimum number of potential suppliers, after consideration of Value for Money, Most Economically Advantageous Tender and Total Cost of Ownership. Essentially, the procurement office is responsible for the entire process, drawing on technical and legal expertise as required.

Roles in cloud procurement are essentially the same as in conventional ICT procurements but the process is not so straightforward and requires continual close collaboration between all three actors. The starting point for ‘going to market’ is the process of selecting the most suitable cloud service model (essentially deciding whether responsibility for the runtime environment and software remains in-house or is to be outsourced), deployment model (which determines the technical, financial and legal parameters) and the procurement approach such as using a catalogue or a cloud broker. These decisions cannot really be taken in isolation of each other.

In all cases there must be a preliminary assessment to understand technical, legal and procurement needs and identify any restrictions, limitations and regulatory requirements that apply, prior even to consideration of the service and deployment models offered by potential suppliers. It may be that additional specific legal clauses need to be used and potential suppliers must be able to agree to these.

Aspects	Public cloud	Private cloud	Community cloud	Hybrid cloud
Provisioning model	Provisioned for open use by general public	Exclusive use by a single organisation	Shared use by a specific community of organisations	Combination of two or more distinct cloud infrastructures
Costing (mode of payment)	Utility (pay per use) pricing	Capital investment for initial set-up	Cost contributed by individual organisations	Mix of public and private cloud pricing
Service Level Agreements (SLAs)	Defined by service provider	Defined by the organisation	Shared by community members	Mix of different SLAs
Possible use	Handling large variations in demand for open, non-sensitive data	Mission-critical systems / handling sensitive data	Community of organisations with shared business needs	Mixed business needs

Figure 2: Comparison table for the four deployment models. Source: Practice Guide for Procuring Cloud Services, Published by the Office of the Government Chief Information Officer, Government of the Hong Kong Special Administrative Region (November 2013)

Carry out pre-procurement market consultation & engagement

Pre-procurement market engagement enables you to consult the market and to examine alternative solutions in the market by obtaining early feedback on the feasibility of the project. It serves to understand what the market can deliver now and in the future: if the gap between needs and capabilities is too great, the procurement action may encounter some issues. Transparent market engagement can also encourage the participation of a wide range of cloud service providers (CSPs). In addition, market engagement coupled with research into the available standards is an important step in assessing which standards are the best to include in the tender. Finally, from the pre-procurement market engagement you can understand if one commercial provider can meet your needs or you need to procure from multiple providers. Make sure to look beyond your regular suppliers and engage with small- and medium-sized enterprises (SMEs). Many of the most innovative solutions come from small-sized companies.

Pre-procurement market engagement can be done using questionnaires or surveys, written submissions, face-to-face, phone or web-based meetings, open days and supplier demonstrations. Publishing a Prior Information Notice (PIN) is key to market the tender in an appropriate way. Preliminary market consultation is not directly regulated by the EU procurement directives, although the new directives state that preliminary market consultations can be carried out provided they do not distort any later competition.

Choose joint procurement to benefit from economies of scale

Cloud service and deployment models are suitable for joint procurement where there is one single tender for all participating authorities, cost of developing specifications & contracts can be shared and combined capacity can improve purchasing conditions. If joint procurement is applied carefully, legal matters such as Data Processor Agreement negotiations only have to be carried out once. There are three critical stages to a successful joint procurement:

Call for interest

Run a preliminary needs assessment and disseminate a "Call for Interest" which briefly describes the nature of the product/service to be procured, with general information on the desired characteristics, together with details of timing, the procedure and contractual arrangements to be followed. This should go to as many potentially interested public organisations as possible. Authorities should be asked to declare an interest in participation by a given date (not committing them to final participation), and to include any specific technical demands they have for the services to be procured and comments on the demands if necessary.

Select a procurement model

The organisations who decide to enter into a joint procurement must carefully evaluate the suitability of the three procurement approaches available to them - subject to national regulations. These can be termed "centralised", "decentralised" and "external".

One approach is to delegate all the procurement procedures, including the publication of the tender, responding to questions and evaluate responses to a Lead Authority. This is normally the authority initiating the procurement, or possibly the largest participating authority and the approach is suitable when participants have a history of close co-operation or other relevant experience. This 'centralised' approach is often less expensive to set up than an external entity and tenders are easier to prepare which helps keep cloud procurement processes as short as possible. See the interesting case of Cloud for Europe⁶.

If the participants do not feel confident to delegate the process – perhaps because the product or service to procure is relatively complex or unfamiliar, a more 'decentralised' or collaborative approach may be appropriate, with responsibilities shared and each participant consulted at each step. For example, all participants would be part of the evaluation panel. It is important to ensure each participant's needs are addressed and more time than usual must be allowed to allow the input of all partners.

Thirdly, the procurement consortium may elect to establish a jointly owned external legal entity that provides common procurement functions on behalf of two or more contracting authorities. This can be cost-effective as a vehicle for a regional buying consortium, for example.

Select a contract type

Rather than having to complete a separate tendering exercise each time an organisation or group of organisations wishes to purchase some products or services, there is a provision for a procurement framework in the Procurement Directive (DIRECTIVE 2014/24/EU⁷) allowing one or more participating authorities to establish individual contracts with one or more cloud service provider(s) in a given period.

The 2014 EC Procurement Directive allows (but does not oblige) member states to designate "Central Purchasing Bodies" (CPBs) that act as wholesalers and intermediaries capable of operating Dynamic Purchasing Systems. A DPS is an all-electronic and flexible equivalent to a framework agreement where suppliers can join at any time without being constrained by fixed cycles as found in, for example, G-Cloud. However, it is not obligatory for the Member State to allow CPBs, and so your national procurement regulations will need to be checked.

Write an effective cloud tender

Put yourself in the provider's shoes. It is important to think about what you are asking for from the cloud vendor's perspective. The best price will be reached when a request for quotation requires exactly what a cloud vendor can offer. It is recommended to have some pre-discussions with potential providers to better understand the solutions they can offer. Potential purchasers may wish to provide performance-test software in order to independently test hardware capabilities.

Buying Infrastructure as a Service (IaaS) is similar in some ways to purchasing traditional ICT goods, although the process is often much quicker than for a typical large scale hardware procurement cycle and procurement time can be measured in months (or even less if using a catalogue) not years. Technical

6 <http://cloudforeurope.eu>

7 <http://eur-lex.europa.eu/legal-content/EN/>

[TXT/?uri=uriserv:OJ.L_.2014.094.01.0065.01.ENG](http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2014.094.01.0065.01.ENG)

requirements are easier to draft and suppliers' offers are easier to understand and compare, although IaaS is a low margin, high-volume business for the supplier and some costs (e.g. data removal, IP issues, data transfer costs) may be less transparent.

Provide accurate specifications, including technical, legal and commercial requirements. Vague technical specifications can be misleading and prevent providers from understanding what should be provided and what the associated implementation costs are. As cloud technologies are very dynamic and new needs could emerge during the implementation phase, specifications on potential evolution of the infrastructure are encouraged. Service contracts based on KPIs are the best way to procure IaaS cloud services. Consider splitting tenders into lots or encouraging consortia to bid, in order to make the volumes manageable. Also, try to make the administrative needs and selection criteria for bidding manageable for smaller, newer companies.

Three specific best practices are:

a. Include all of the following in your Invitation to tender/ Request for quotation:

- » The specification of needs.
- » Description of the procurement evaluation process and criteria.
- » An indicative amount which corresponds either to a guideline for the preparation of the price submission, or to an absolute budgetary limit of the funding available.
- » The eligibility criteria for CSPs wishing to bid.
- » The approach to management of risks.
- » Details of the distribution of rights and obligations of the parties in the tender documents which are not part of contract renegotiation.

b. Request appropriate documentation that providers are able to supply in a timely manner. Bidders, especially small suppliers, may find it difficult to provide some documentation.

c. Provide draft contractual guidelines that enable tenderers to know the 'rules of the game' when they prepare their offers, and minimize or avoid the subsequent effort of negotiation of the contract terms.

Consider the need for a pilot phase

Moving from traditional ICT to a cloud computing model will involve significant uncertainties. The change of platform and provision will affect efficiency, and hence the amount of resources required, and cost. However, before the tasks are run it is impossible to predict the performance implications. Running benchmarks on cloud systems in a free trial can help significantly although there will be overheads for both supplier and purchaser. Starting small is one of the key success factors of a procurement action of cloud services. The inclusion of a pilot phase in the procurement action is something that has to be considered in a flexible procurement model of cloud services.

Define objective eligibility criteria for Cloud Service Providers

Procurement documents should identify eligibility criteria for Cloud Service Providers (CSPs) including:

- » Any constraints on jurisdiction and applicable law of the supplier.

- » Evidence of capacity to deliver required service levels (see piloting/trialling, above).
- » Minimum contract duration.
- » Certifications required by the procuring organization. see, for example, the ENISA Cloud Certification Schemes Metaframework⁸. Compliance with specified standards and practices for interoperability such as Topology and Orchestration Specification for Cloud Applications (TOSCA⁹).
- » Compatibility with privacy and data protection requirements in line with COM (2012) 9 "Safeguarding Privacy in a Connected World"¹⁰.

Identify technical requirements clearly

Security system requirements: focus particularly on security of information/data. Too much security means more cost and more technology layers. Too little security means too little protection from malicious intent. Both are bad.

- » Requirements include protection of information and information systems from unauthorized access, use, disclosure, disruption, modification, or destruction to help ensure integrity, confidentiality, and availability¹¹.
- » Understand and document the value and security requirements for your data: the protection (including, physical, cyber, legal and personnel) you would want and expect to see from any potential supplier.

Interoperability requirements: focus on whether and how the cloud provider ensures data portability (for moving data between systems) and interoperability (when upgrading software or when migrating between two competing systems).

- » Certified adherence to industry standards¹² reduces your exposure to the risk of lock-in. Ending a contract for a cloud service, whether by the cloud consumer or the cloud provider, introduces additional considerations, such as what must happen to data held by the cloud provider.

Legacy Systems requirements: focus on support for the organisation's (often large) base of legacy computing applications. They require an experienced re-engineer and the possibility to perform a standalone test. Productivity and business continuity cannot suffer during a migration.

- » Organisations should create mirror systems of key legacy applications – one on the new cloud platform, another on the existing platform, and compare performance, reliability, functionality before cutting over to the cloud-based version. Also, organisations should consider moving the most critical legacy applications last.

8 <https://www.enisa.europa.eu/media/press-releases/enisa-cloud-certification-schemes-metaframework>

9 https://www.oasis-open.org/committees/tc_home.php?wg_abbrev=tosca

10 <http://eur-lex.europa.eu/legal-content/en/ALL/?uri=CELEX:52012DC0009>

11 See the ENISA Security Framework for Governmental Clouds <https://www.enisa.europa.eu/activities/Resilience-and-CIIP/cloud-computing/governmental-cloud-security/security-framework-for-govenmental-clouds> and the ENISA Security & Resilience in Governmental clouds report <https://www.enisa.europa.eu/activities/risk-management/emerging-and-future-risk/deliverables/security-and-resilience-in-governmental-clouds>

12 See the NIST Inventory of Standards Relevant to Cloud Computing <http://collaborate.nist.gov/twiki-cloud-computing/bin/view/CloudComputing/StandardsInventory> and the CloudWATCH Cloud Standards Guide <http://www.cloudwatchhub.eu/cloud-standards-guide>.

Identify legal requirements clearly

Data location requirements: focus on compliance with justifiable jurisdiction limitations on data residence and transit between locations. Currently, some courts are holding that the legal jurisdiction over a contract dispute involving data takes place in the state where the data physically resides. Therefore, it is important to specify constraints on data storage location predicated by law, regulations, or governing policies. The contract should also outline the determination of jurisdiction and applicable law by which any legal disputes will be settled, taking into account provisions of the upcoming European Commission Free Flow of Data Initiative.

This is particularly relevant in case of cross-border procurement. When processing of personal data takes place in countries not offering adequate safeguards, both the client (controller/exporter of data) and the provider (processor/importer) must sign the model clauses adopted by the Commission with Decision 2010/87/EU. Personal data can be freely transferred outside the EU, provided that the client verifies that:

- » One of the conditions listed by article 26 is fulfilled.
- » The recipients of personal data signed the standard model clauses approved by the European Commission.
- » The recipient organization has Binding Corporate Rules approved by the EU Data Protection Authorities in place.

Privacy and confidentiality requirements: focus on the applicable privacy law which in the EU is the law of the Member State where the data controller is located, which means the law of the State where the cloud client resides.

» Ownership rights to data and clear access requirements have to be specified. Data Ownership refers to the legal custody, control, and/or possession of data (e.g. data custody, intellectual property, exclusion of data mining or selling, data processing ownership). In the context of cloud contracting, this section of the contract establishes the public sector's ownership of its data stored in the cloud. Cloud contracts should clearly state who owns the data residing in the cloud.

Security requirements: focus on ensuring that unauthorized parties do not obtain access to sensitive data. In that sense, security is related to privacy. Outside of specially protected sectors, it is usually up to the parties to include a security framework in the contract for cloud computing services.

- » Data access control typically defines those persons in an organization who have the authority to view or retrieve organizational data housed in the cloud. Usually a public research organisation should be able to access and retrieve its data stored in the cloud at its sole discretion, including the right to access all data regardless of content creator.
- » It is the buyer's responsibility to establish that the vendor's security practices satisfy any buyer-specific requirements over and above relevant legislation.
- » A data security breach occurs when there is a loss or theft of, or other unauthorized access to, sensitive personally identifiable information that could result in the potential compromise of the confidentiality or integrity of data. Breach disclosure requirements should be addressed in the cloud contract and the processes and procedures to be followed in the event of a data breach, including notification requirements, timelines, detailed information about such breaches, and remediation activities should be articulated.

Data protection & privacy requirements: focus on understanding of what data you are putting in the cloud, who needs access to it and the impact of differences in legal and regulatory compliance requirements depending on the location (and thus the jurisdiction) of your data including resilient copies.

- » Keep a record of what type of data is stored in the cloud. Protect personal data according to your needs and avoid sharing out data to unintended parties by ensuring only the intended recipients have access permissions if you share sensitive data with others through the cloud. Define the data protection roles between the parties as well as control rules.
- » Bind the data cloud service provider, acting as a data processor, by means of a specific data processing agreement, or at least make sure that the boundaries of the data processing are clearly defined in the Cloud Service Agreement and that the activities outsourced to the cloud service provider are adequately circumscribed. The degree of autonomy left to the data processor in the choice of methods and technical or organizational measures must be defined.
- » Privacy provisions for personal or confidential business information must be in accordance with applicable standards expressed in the buyer's internal policies and must also comply with relevant legislation as a key performance measure.

Identify commercial requirements clearly

Performance requirements: focus on a level of performance that is achievable, not just the minimum performance defined by SLAs. The relationship between financial incentives and well-defined and achievable performance measures needs to be understood. A contract based on delivery of minimum service levels set by the customer tend to result in the minimum necessary performance to achieve those levels because there is no incentive to improve. Put bluntly, once a supplier has met their target it is probably in their commercial interest to divert effort into other work where targets (and therefore payments) are at risk.

- » Two typical performance measures are downtime and throughput. There is a world of difference in terms of impact on the customer organisation between a service that is unavailable for six hours once a year (a situation which should be avoided by providing suitable redundancy) and one that is down for a minute every day (which is probably acceptable for many scenarios). Yet both can claim to be available for 99.9% of the time. Rather than simply paying for 'uptime', cloud-users may need to think in terms of the need for dynamic reconfiguration as a way of ensuring throughput even if demand is heavy (expressed, perhaps, in terms of wait-time before a VM becomes available).
- » Disaster recovery requires a different kind of performance measure, based on mitigation of risk rather than penalties in the event of a disaster occurring. The vendor must be asked to demonstrate its redundancy provisions and regular audit checks need to be included in performance measures. This is even more critical where the vendor subcontracts to another cloud service. In these cases the vendor will need to provide an attestation that its provider has suitable disaster recovery processes.

Continuity requirements: focus on precisely specified responsibilities for all potential areas of breach in the

contractual agreement. Each requirement will differ according to the nature of the data, the industry and any regulation and purpose for using the service. Arbitrary suspension of service or payment for service should be avoided and consequences of each form of breach should be addressed explicitly. This is especially important in a multi-tenant cloud where one user could compromise the service of another.

- » There should be an agreed response to extended non-availability of service (based on an agreed definition and timing of downtime) such as payment suspension, which can be applied automatically. A downtime calculation needs to start precisely when services are suspended, not when the buyer notifies the vendor.
- » Termination notice timeframes need to be agreed between both parties unless there is a material breach. These breach terms need to be clearly spelled out in the contract. This gives the buyer sufficient time to secure its data and seek alternative service providers.
- » Liability must be capped, normally as some calculation based on the value of the contract (in total or to date) or the nature of the potential loss to the buyer, such as intellectual property.

Assess cloud-specific Terms of Service carefully

Dynamic and changing cloud services must be monitored to ensure proper performance and benefit realization. The purpose of contract management & monitoring is also to ensure the contractor is adhering to the terms and conditions of the contract and is providing the required services/products that meet the expectations of the purchaser. In addition, as cloud services are billed regularly based on usage, the user should establish processes review and approve the billing and metering of cloud services. This will ensure that billed items and usage are directly matched. Some cloud services providers offer cost forecasting tools or usage notification services. The user should take advantage of such services if they are available.

There is no standard format for the Service Level Agreements (SLAs) and other Terms of Service that form the basis for evaluation of the offers made by cloud service providers and which become part of the resulting contract. They include parameters different from those that appear in the descriptions of traditional ICT services. The greater flexibility of a cloud computing service as compared with a traditional ICT contract means the customer has to fully understand all the aspects of the terms of service. Performance management issues are discussed in the previous section on terms of service and performance monitoring. Assessment of cloud offers must include compliance with stated requirements such as the location of data placed into the cloud and the legal foundations of any contract with the provider.

Pricing

Make sure the cloud service provider (CSP) has responded with pricing breakdowns that show which requirement(s) the price relates to, this will make comparing proposals much easier. Make sure when evaluating different CSPs that pricing assurances are included in the cloud contract. These include cost per unit or contract costs, and provisions to adjust pricing downward if the identical services (including functionality,

quantities, and total contract cost) are provided to other clients at a lower cost, etc. Volume discounts are frequently offered by CSPs and need to be factored into the cost comparison. One factor that affects price once the service is deployed is the risk that demand will spiral out of control. A mechanism for monitoring this may be provided by the supplier if the buyer cannot constrain the multiple individuals/groups independent use of the service.

Disposition of Data Upon Request or Termination

Data disposition refers to the procedures and processes used to destroy data when the contracting entity requests such destruction or a contract is terminated by either party. Processes and procedures for data disposition upon contract termination or organizational request should be described in the contract.

Legal Data Holds/Public Record Requests

Litigation holds and public records responsibilities are also critical and should be included in contracts for cloud services. Compliance with public records laws and legal data holds is also a core part of cloud contracts.

Compliance with laws & regulations

Contractual arrangements regarding the jurisdiction and the applicable law must be included in the Cloud Service Agreement:

- » Choose a cloud service provider who guarantees compliance with European data protection law, making sure compliance is reflected in the contract, and that the roles of data controller and data processor are clearly defined;
- » Avoid providers who use a complex chain of sub-contractors located outside the EU.

Terms and conditions & functionality modification

It is important to contractually codify the functionality of the services procured from the cloud provider so that any unanticipated change in functionality that interferes with the customer's ability to use the service in the way intended can be identified and resolved.

Contracts – which include the supplier's terms and conditions – should clearly regulate which services and under what conditions, including procedural ones, can be modified in the course of the provision of services. Changes that are materially detrimental to the level of a mission critical service or/and to the level of protection of personal data should be explicitly excluded in the contract.

Changes should not be implemented without giving prior notice to the client. The written agreement of the client, or at least the client's right to be notified prior to any changes to the contract, should be contractually foreseen including the right to termination in the event of unwanted, unnoticed and/or detrimental amendments to the contract.

Many cloud contracts incorporate standard terms and conditions by reference to the relevant URL at the cloud service provider's web-site. The terms and conditions that apply at the time of contract signature should be incorporated as an exhibit for future reference purposes in case the published terms and conditions are updated.

Contract renewal and termination

Termination of cloud computing contracts is a critical phase because it initiates a process in which the client must be able to retrieve the data transferred to the cloud, within a specified period of time, before the provider irreversibly deletes them. This phase, if not managed properly can also be costly. The steps of the termination process must be clearly identified in the cloud service agreement between the parties. A good cloud service agreement would contain provisions regulating the data retrieval time, the data retention period as well as the procedures followed by the provider in order to transfer personal data back to the client or to allow the latter to migrate to another provider. Exit strategies when moving to the cloud should be carefully defined to avoid vendor lock-in.

Select the most suitable procurement procedure

As cloud services evolve rapidly, shorter procurement cycles are envisaged. The selection of the most appropriate procurement procedure usually depends on a number of issues: the type and size of the procuring organization; the value and complexity of the procurement action; the budget and the competences available to conduct the procurement; etc. The most common public procurement procedures are the open or restricted procedures although regulations have been updated with the adoption of the EU Public Contracts Directive (2014/24/EU) which introduces many changes, summarised in a Brief Guide by the UK Crown Commercial Service¹³ which gives updated definitions of the expected use of each procedure:

The new Directive introduces a new Innovation Partnership procedure and simplifies the scope of the existing Competitive Dialogue and Competitive Negotiation. The options are:

- » The Open procedure, under which all those interested may respond to the advertisement in the OJEU by submitting a tender for the contract.
- » The Restricted procedure, under which a selection is made of those who respond to the advertisement and only they are invited to submit a tender for the contract.

- » The Competitive Dialogue procedure, under which a selection is made of those who respond to the advertisement and the contracting authority enters into dialogue with potential bidders, to develop one or more suitable solutions for its requirements and on which chosen bidders will be invited to tender.
- » The Competitive Negotiation procedure under which a selection is made of those who respond to the advertisement and only they are invited to submit an initial tender for the contract. The contracting authority may then open negotiations with the tenderers to seek improved offers.
- » The Innovation Partnership procedure, under which a selection is made of those who respond to the advertisement and the contracting authority uses a negotiated approach to invite suppliers to submit ideas to develop innovative works, supplies or services aimed at meeting a need for which there is no suitable existing 'product' on the market. The contracting authority is allowed to award partnerships to more than one supplier.

In certain narrowly defined circumstances the contracting authority may also award a contract using the 'negotiated procedure without prior publication'. Here the contracting authority would approach one or more suppliers seeking to negotiate the terms of the contract. One of the permitted circumstances is where, for technical or artistic reasons or because of the protection of exclusive rights, the contract can only be carried out by a particular supplier.

Contracting authorities have a free choice between the open and restricted procedures. The competitive dialogue procedure and the competitive procedure with negotiation are available where certain criteria are met, including where the contract is complex or cannot be purchased 'off the shelf'. The 'negotiated procedure without prior publication' may only be used in the limited circumstances described in the Public Contracts Directive.

The key features of each of the procedures, including the new Innovation Partnerships, are shown below.

Process steps		Open	Restricted	Competitive	Negotiated	Innovation Partnership
Award	Procurer selects against criteria	y	y	y	y	
Negotiation	Procurer negotiate terms of contract with (suppliers)	n	n	n	y	
Final tender	Supplier responds to revised invitation to tender	n	n	y	n	
Dialogue	Procurer enters into dialogue with shortlisted suppliers	n	n	y	y	
Tender	Supplier responds to tender documents	y	y	y	y	
Shortlist	Suppliers selected for shortlist on basis of PQQ	n	y	y	y	
PQQ	Supplier completes a pre-qualification questionnaire	n	y	y	y	
Specification	Publication of the advertisement	y	y	Y	Y	

¹³ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/472985/A_Brief_Guide_to_the_EU_Public_Contract_Directive_2014_-_Oct_2015__1_.pdf

Notes on specific provisions:

- » All tenders over specified value must be advertised in OJEU. Lower-value tenders may optionally be advertised.
- » All procedures except the Open procedure use a pre-qualification step to reduce the number of potential suppliers that have to be considered for shortlisting. The minimum number of shortlisted suppliers is three (or five in the case of the Restricted procedure).
- » In the Open and Restricted procedures, potential suppliers submit their responses to the tender documentation. These are assessed and the supplier chosen.
- » In the Competitive Consultation procedure a structured dialogue is used to clarify key points prior to issuing a final tender document.
- » In the Negotiated procedure, the structured dialogue and tendering process of competitive consultation is replaced by a more flexible approach, the use of which is limited to very specific circumstances.

Choose innovation partnerships if you are procuring new cloud services

Innovation partnerships are new procurement models that address two obstacles to adoption of innovation in products and services. These can work well for more sophisticated forms of cloud procurement such as PaaS / SaaS. The first step is to stimulate R&D that can result in competing approaches to problem-solving so that they can be evaluated and the most promising prepared for introduction to the market. This is addressed by the PCP mechanism. The second step is to encourage adoption of those new-to-market products and services through a PPI project.

Pre-Commercial Procurement (PCP) is an approach for procuring R&D services, in three phases prior to the availability of goods and services: solution exploration, prototyping and test implementation. This enables public procurers to:

- » Share the risks and benefits of designing, prototyping and testing a limited volume of new products and services with the suppliers, without involving State aid.
- » Create the optimum conditions for wide commercialization and take-up of R&D results through standardization and/or publication.
- » Pool the efforts of several procurers.

Public Procurement of Innovative Solutions (PPI) is a mechanism that can create demand long before a commercial market is established. This has three key advantages:

- » By acting as the first buyer or lead customer, a public sector procurer can boost a specific new market.
- » This provides a mechanism for stimulating market interest in the results of PCP. Together, PCP and PPI can lead to scientific and technological breakthroughs in areas such as health and well-being, food security, sustainable agriculture or clean & efficient energy.
- » New and innovative public services can be provided in a more cost-efficient and effective manner by the use of more mature solutions.

The most complex aspect of the PCP/PPI instruments is the potential that exists for conflict with state aid and public procurement law. Communication 799 (2007) makes the case

that PCP does not constitute state aid and that R&D was excluded from the public procurement Directives (Art 16f of 2004/18/EC, Art 24e of 2004/17/EC). Although these have now been replaced by Directive 2014/24/EU and Directive 2014/25/EU, COMM 799 still applies to PCP. PPI is regulated by these new public procurement Directives and Directive 2014/23/EU.

The way intellectual property is to be exploited must comply with relevant law (see above). PCP/PPI involves an investment in making new ideas a reality, both by the contracting authority and the supplier(s) or service provider(s) involved. Each will want to recoup its investment, and this often takes the form of asserting intellectual property rights (IPR). In order to capture the benefits of innovation which are most important to it, without paying unnecessarily for rights and options which won't be used, the contracting authority should develop a strategy on IPR which takes into account the likely future applications of the product or service it is purchasing. IPRs resulting from a PCP are not exclusively reserved to the procurers, but shared between procurers and bidders. Recommendation: ownership assigned to bidders and use/development rights assigned to procurers, through licences and sublicences scheme, and just for purposes linked to the procurers public mission and within their territorial scope.

Three considerations for successful PCPs and PPIs:

1. In PCP and PPI the dialogue with industry is fundamental in obtaining an overview of the state of the art and of the available technologies.
2. Accurately define risks and responsibilities: Buying innovative solutions will inevitably entail a certain amount of risk, whether technical or financial. It is important to carefully consider what those risks might be and to make sure that it is clearly defined who is responsible for carrying that risk, and that this be clearly included within tendering and contract documents. A piloting phase can help to substantially reduce risk¹⁴.
3. The award of a PCP/PPI cannot be based on lowest price only. The PCP/PPI contracts shall be awarded to the tenders offering the most economically advantageous tender, taking into account other factors than price (e.g. quality).

Write up case studies of procurement exercises to share best practice

It is important to draw lessons for future procurement from each procurement process and to share best practice and lessons learned. The PICSE report "Procuring cloud services today: experiences and lessons learned from the public sector"¹⁵ provides several case studies. The effect of using certain standards or other technical specifications can be assessed, as well as the accuracy of any cost benchmarking exercises. This evaluation can also be used to assess suppliers in the market in terms of the extent to which they have met required technical specifications in their products or solutions.

14 https://www.innovation-procurement.org/fileadmin/editor-content/Guides/Intellect_Property_Rights_guide-final.pdf

15 <http://picse.eu/news/new-report-experiences-and-lessons-learned-the-public-sector-procuring-cloud-services-today>





