

Procuring cloud services today

Experiences and lessons learned
from the public sector







Digital transformation is absolutely crucial to any organisation whether public or private. It is at the very core of the digital single market to ensure Europe reaps the socio-economic benefits of new technologies. Cloud computing has the potential to reduce IT expenditure and boost organisational agility while at the same time improving the scope for delivering flexible high-quality new services.

Barriers to the adoption of cloud services range from the shift to new procurement processes to match the cloud's on-demand model, lack of trust and security, lack of mature technical standards to complex legal terms and fear of vendor lock-in. Overcoming these barriers is key to boosting public sector productivity and efficiency, meeting a new set of user demands in a way that ensures secure and reliable and compliant with institutional requirements.

This document describes the experience of thirteen public sector organisations across Europe who have either carried out a process to procure cloud services, or are considering doing so. The experiences vary in terms of success and offer insights into how the procurement of cloud services is impacting on their current processes.

What are the main challenges they face in purchasing cloud services?

Are organisations able to apply or adapt existing standard procurement policies in order to benefit from what cloud service providers offer?

Do staff have the necessary skill-sets to assess the market and make the right choice?

The results of the case studies analysis will feed into the PICSE Roadmap on the procurement of cloud services, which will be published in early 2016.

A summary of the main findings

Building on the case studies, an analysis was completed to consider the outcomes and to identify common trends experienced in each study. Based on this, a detailed set of conclusions has been produced for the following areas:

- » Skills necessary to run a successful cloud procurement process
- » How to write effective specifications in a cloud tender
- » Recommendations on how to procure IaaS
- » Pros & cons in deciding upon a joint procurement process
- » Procurers' wish list for procuring cloud services
- » Main barriers faced by public sector organisations in procuring cloud.

Having the right skill-set

1. Equip your organisation with the right skills. Having the right skill set is fundamental for managing a successful procurement process. Organisations with strong technical skills in cloud computing, a skilled procurement office and legal team are much better prepared for procuring cloud services and have a higher success rate.
2. Allocate fractions of research grants to the use of cloud computing.
3. Make sure you seek legal advice. Legal aspects and Data Processor Agreements are fundamental for public entities procurement.
4. Carefully define exit strategies when moving to the cloud to avoid vendor lock-in.
5. Put in place appropriate performance and costs monitoring systems. When buying cloud services, make sure that costs can be allocated to different cost centres (e.g. splitting the invoice internally to departments, projects, etc).

Writing an effective tender

1. Put yourself in the provider's shoes. It is important to think about what you are asking from the cloud vendor's perspective. The best price will be reached when a request for quotation matches exactly what a cloud vendor can offer.
2. Talk to the providers. When writing tender specifications, there is a tendency to write the request in a very inward looking and limiting way. It is recommended to have some pre- discussions with potential providers to better understand the solutions they can offer.
3. Be accurate with the technical specifications. 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, specifying the potential evolution of the infrastructure are encouraged.
4. Market and prepare vendors for the tender: Prior to launching the tender, a targeted marketing campaign highlighting the forthcoming tender to some of the main contenders should take place in order to ensure that a minimum number of responses. Simply emailing individual cloud providers isn't enough.

5. Standard and well-defined specifications work best; e.g. in the case of procurement of Infrastructure as a Service, contracts for a 12 month period are recommended, rather than shorter time-periods. Will impact the price, or whenever the deal is too small to support that extra cost. A request for quotation requires a salesperson to ensure approval for pricing suitable for the deal. Getting approval for non-standard deviations could be problematic.
6. Be careful to any deviation from a standard offering. The cost of managing that deviation
7. 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.
8. If your tender is unsuccessful, contact the vendors to find out why they didn't respond. This will greatly help in preparing the next version.

Procurement of IaaS can be easier

1. Buying Infrastructure as a Service (IaaS), combined with an independent performance test, is similar to purchasing traditional ICT goods. This is why technical requirements are easier to draft and suppliers' offers are easy to understand in terms of the proposed pricing. The level of confidence for SaaS/PaaS is not the same.
2. The procurement process of cloud IaaS is shorter when compared to a traditional procurement of large-scale H/W resources (e.g. 1 year from start to finish for a typical large scale H/W procurement cycle compared to 3/4 months for a cloud procurement).
3. IaaS is a low margin, high-volume business for the supplier; which procurers need to be aware of.

Joint procurement gives you more opportunities

1. Joint procurement actions can reduce the cost of developing specifications & contracts.
2. Issues in purchasing as a single customer have been identified as follows:
 - a. Uneven negotiation power between Cloud Service Providers and Customers (especially with big cloud providers). Services cannot be customised according to customer needs and usually no price negotiation is allowed.
 - b. The number of services available / offered is limited or the services that customers want to buy are still immature.
 - c. There is a lack of confidentiality assurance in IPR management and a lack of service interoperability.
 - d. Service Level Agreements are not clear, badly defined and cannot be compared.
 - e. Stringent legal and regulatory requirements.

The procurers' wish list

1. Transparency in cataloguing services.
2. Catalogues of cloud service providers.

Main barriers in procuring cloud services from commercial providers

3. Cloud brokers at all levels (e.g. IaaS, SaaS, PaaS, skills brokerage, Information brokerage) can speed up the cloud purchase, especially for cloud marketplaces and for organisations lacking skills in cloud computing.
4. A standalone test that could be used to verify the suitability of the services offered by the suppliers.
5. Sample templates and guiding graphs to write public tenders.
6. Accounting of cloud resources and comparing costs supported by standards.
7. The support of a public body whose role it is to support education and research by providing leadership in the use of information and communications technology in learning, teaching, research and administration can help organizations understand the significance of new technological developments.
8. Cloud marketplaces with a framework agreement. However, cloud marketplaces still require further development and the harmonisation of European public research organizations procurement schemes will help in kicking-off marketplaces and in reaching a critical mass.

1. Privacy and security of cloud solutions: moving data to a commercial provider is risky. Many organisations manage sensitive data that cannot be publicly disclosed.
2. Data privacy management is strictly related to data security and legal frameworks in organisations, in particular to data protection. Cloud service providers are expected to guarantee that the data stored cannot be accessed by other parties.
3. Due to the cross-border nature of some research organisations, deciding the law applicable to data and cloud solutions can be unclear.
4. Procurement of on-demand services is an issue as existing procurement policies are suitable for fixed price purchases. They do not cater for pay-per-use or on-demand services offered by cloud service providers, for which monthly invoices may differ.



Nine experiences of procuring cloud services

1. Purchasing IaaS through a public tender

The procurer	European public translation service provider
Type of procurement approach	Commercial procurement
Geographical coverage of the procurement	Europe and Associated Countries
Cloud services procured	IaaS – Basic compute capacity such as CPUs and storage.
Users	Organisation staff and public sector users.
Scale of the procurement	Under €60,000
Actors involved in the procurement process	Technical officer, legal officer, procurement officer, five cloud service providers.
Procurement outcome	First tender published in 2010 but no bidders. Second tender prepared in 2011 but not publically launched.

The Procurer

We provide machine translation services in over twenty languages to our staff of over 2,500 and a much wider community of public sector users. Our department is part of a public translation service provider.

Our organisation's procurement process follows the general principles of the European Union's (EU) procurement rules: transparency, fair and equal treatment, consistency, integrity and accountability.

The types of procurement procedures used are:

- » Open call for tenders where an evaluation committee is appointed which examines all the offers;
- » Call for expressions of interest.

Why the cloud?

The machine translation service uses an extensive catalogue of human translations. In providing the service we faced the following challenges:

5. Training the machines requires a lot of data;
6. Statistical computation is very expensive in terms of resources.

During the machine training phase, translation and language models are built which will then be used to translate new text. Considering that models are built to support more than 70 direct language pairs and it takes around 2 weeks to train each engine, the reduction of the computational time is fundamental and should be done on a scalable infrastructure. Usually, the machine learning procedure takes place four times a year, and takes 2 months.

Having access to a flexible and scalable cloud infrastructure with powerful computational resources would reduce time taken and provide flexibility.

We also need large amounts of disc space and RAM to store and process the large volume of temporary data managed by the system. The data generated and managed during the intermediate stages are much larger than the input data, at around 300GB (made up of millions of sentence pairs). There are also many cores to parallelize.

When the machine translation project began, cloud computing was considered as a possible solution to overcome the storage,

the computational, the flexibility and scalability issues. In addition, at the time, the internal capacity to cover this was not available to us. We were also attracted by the more convenient prices offered by the cloud providers. Therefore, we decided to go for a tender procedure.

How we procured cloud services

Our organization prepared two tenders to procure cloud services. The first was launched in 2010, while a follow up tender was prepared but never publically launched in 2011.

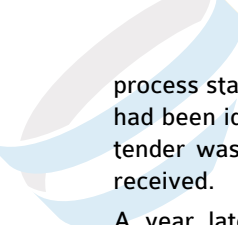
At the very beginning of the pilot in 2010, we decided to launch a restricted call for tenders to procure IaaS. The decision was taken as we only had one month to launch the tender so as to benefit from available budget resources, which were below the required threshold for restricted calls (€60.000) that is set by our organisation. This allowed us to start small with a pilot and avoid a long and complex open tender procedure.

An internal team was put together and in 2-3 weeks released the tender. No cost evaluation was carried out due to time constraints and a market analysis was completed by the team based on internet research only.

Originally, we thought that the tender technical specifications were relatively easy to define as we knew exactly how many resources were required. However, issues arose when we approached our legal department to approve the tender. Cloud computing was a completely new subject for our legal advisors and they were unsure how to purchase the new technology. Their doubts were mainly related to the security issues such as the confidentiality of data, the location of the data, etc. However, after much discussion we finally got their approval.

We then faced challenges related to the procurement process. Our organisation has very strict tendering procedures that don't match well with the common purchasing practices related to IaaS, where services are offered through a web interface and are regulated by a payment through a credit card. Our procurement department requires for instance paper invoices, etc. Moreover, our organization does not usually adapt its own terms to the terms of service providers, but rather requests providers to abide to its terms.

To overcome some of the procurement issues, the negotiation



process started with the tender being sent to 5 suppliers who had been identified through the internal market analysis. The tender was open for three months. However, no reply was received.

A year later in 2011, we prepared a new tender on the same topic. However, this was not published because our organisation started preparing a new larger tender to procure cloud solutions.

We are now waiting for the new tender process to be opened by our organization.

What we learned

What worked well:

- » Technical specifications were relatively easy to develop

What didn't work well:

- » No answers to the tender were received
- » The legal team had no experience with cloud technologies.

They were unsure about data security. This caused a delay of 2 weeks before the launch of the tender.

- » Our organization has strict procurement policies which did not facilitate the process. For example, tenderers are required to accept the terms without any flexibility; purchasing through web interfaces and paying by credit card is unforeseen.
- » We left open most of the typical SLA conditions to be set by the providers, as there was no experience on the technical side about how to deal with Cloud computing provision.

Wish list

- » Guidelines on how to write technical specs, formulating needs in a way compatible to cloud computing service offer and including legal aspects.
- » Our organisation's current procurement procedures on cloud computing market and identification of points requires updating.

2. Joint pre-commercial procurement for better cloud adoption in the public sector

The procurer	Consortium of 5 government ministries
Type of procurement approach	Joint pre-commercial procurement
Geographical coverage of the procurement	Europe and Associated Countries
Cloud services procured	Federated certified service brokerage Secure legislation-aware storage Legislation execution
Users	Public Sector staff
Scale of the procurement	€4 million
Actors involved in the procurement process	Public authorities that use and/or provide cloud computing, procurers of IT services, cloud service providers, providers of IT solutions to the public sector (including SMEs and associations), standardisation bodies
Procurement Outcome	Over 25 service providers submitted a bid

The Procurer

We are a project co-funded by the European Commission under the Framework Programme for Research and Innovation (FP7) that aims to support public sector cloud use as collaboration between public authorities and industry. Supported by stakeholders from the public sector, industry and standardisation bodies, the main objectives of our project are to:

- » Identify obstacles for cloud use in the public sector;
- » Define services that overcome these obstacles;
- » Procure research from industry to find innovative solutions for cloud services.

The project addresses the objectives of the European Cloud Partnership and helps partners to adopt a well-defined European Cloud Computing Strategy for the public sector. The project started in June 2013 and runs until November 2016.

We use pre-commercial procurement as an instrument for public sector innovation. Pre-commercial procurement permits industry to develop R&D innovative cloud services that best fit public sector needs, but also provides public procurers the possibility to jointly discuss with industry the potential of cloud services

Why the cloud?

Five public entities from five different countries in the EU came together to start a procurement action of cloud services. The objective was to research and demonstrate solutions to overcome obstacles for the adoption of cloud computing by the public sector. Their objective was to address issues that are encountered when trying to purchase cloud services as single customers.

The main driver behind these organizations wanting to procure cloud services was to lower the Total Cost of Ownership; to shorten the procurement and service provisioning process; and to purchase services that fit their needs.

The following issues in purchasing as a single customer were identified:

- » Imbalanced negotiation power between cloud service

- providers and customers (especially with big cloud providers). Services cannot be customised according to customer needs and usually no price negotiation is allowed;
- » The number of services available / offered is limited or the services that customers want to buy are still immature;
- » There is a lack of confidentiality assurance in IPR management and a lack of service interoperability;
- » SLAs are not clear, badly defined and cannot be compared;
- » There are stringent legal and regulatory requirements.

How we procured cloud services

Joint pre-commercial procurement was considered as the best way to procure as the solutions available on the market did not fit the public sector needs. In pre-commercial procurement the dialogue with industry is a major task. This allows cloud customers (the public procurers) to run a comprehensive market analysis which is helpful in obtaining an overview of the state of the art and of the available technologies.

The PCP process itself is separated into three phases. Each phase is open for competitive solutions that are provided by bidders. The phases comprise solution exploration, prototyping and test implementation. After each phase bids are evaluated to find the best solutions.

The main result of a pre-commercial procurement is a pilot to test the solution. A second procurement action is then needed to purchase the product. This can be carried out as a commercial procurement or as a public procurement of innovation (PPI) action.

The purpose of the tender that we published was to research and demonstrate solutions to overcome obstacles for the adoption of cloud computing by the public sector. The PCP invited suppliers to bid for any or all of three services (lots), each of which provides a framework agreement for research and development services. Three lots were identified for a total budget available of 4 million:

- » Federated certified service brokerage
- » Secure legislation-aware storage
- » Legislation execution.

The tender remained open for four months. A total of 29 service providers from 11 countries – Italy, Austria, Estonia, France, Germany, the Netherlands, Romania, Slovakia, Spain, Switzerland, and the United Kingdom - submitted their bids. A variety of economic operators were involved: 45% SMEs, 24% large companies and 31% public research bodies. Most of the offers, 13 in total, were submitted for lot 1 (federated certified service brokerage), followed by 7 offers for lot 2 (secure legislation-aware storage) and 4 offers for lot 3 (legislation execution). The evaluation committees are currently finalising the evaluation of the tenders. All three evaluation committees are composed of three experts from different countries.

What we learned

What worked well:

- » The approach of a pre commercial procurement action: The dialogue with the industry helped the public procurers to better understand what the cloud market has to offer and to identify where the gaps are.
- » The joint procurement action: Different European ministries compared their needs and their desiderata and they realized that they have similar requirements. This can be seen as a harmonization of requirements. The mapping of these

requirements to available products helped to identify the challenges needed to request R&D services in Cloud Computing for the public sector.

What didn't work well:

- » Writing the tender was time consuming: As PCP is a relatively new instrument in procurement, the preparation of the contracts is different from commercial procurement and needs to be developed carefully which was time-consuming. However, the experience with PCP will be shared with other public sector procuring entities and can, as best practice, be shortened in the future.

Wish list:

- » Currently, the public sector has a complex and long-developed system landscape, where system components are integrated from different vendors. Based on that culture and in order to avoid vendor-lock-in, the procurement of cloud services will not change that behavior. Cloud services will be procured from different vendors. A pre-requisite for this is that these services are standardized and interoperable.
- » The public sector needs to be in line with the procurement legislation, and thus, open competition is one of the key factors they are bound to.
- » Regarding cloud marketplaces, the cloud services available via them need to be in a form which allows competitive selection of cloud services. They should also fulfill the procurers requirements, for example in terms of potential certification, openness for integration, comparison of SLAs.

3. Procuring cloud services from commercial providers and a cloud marketplace

The Procurer	International organisation
Type of procurement approach	Commercial Procurement of IaaS Procurement from a cloud marketplace
Geographical coverage of the procurement	International European
Cloud services procured	IaaS SaaS
Users	Organisation employees Communities interested in the data of the procurer
Scale of the procurement	Not disclosed
Actors involved in the procurement process	Initiator, Technical Officer, Procurer, Financial Officer, Tenders Evaluation Board
Procurement outcomes	Several successful commercial procurement actions completed For the cloud marketplace the procurement is not started yet

The Procurer

We are an international organisation with 20 Member States dealing with large amounts of scientific data, developing satellite-based technologies and services, and promoting European industries.

Our procurement process is designed to achieve the best possible trade-off between the objectives of technical excellence, economy and industrial policy as defined in our procurement regulations. It is also implemented so as to give tenderers the guarantee that the competitive procedure will be conducted in complete fairness and that their offers will be evaluated with the greatest care and total impartiality.

The implementation of the procurement procedure is a joint task of the technical team in initiating services and the procurement department. A major task of representatives of the procurement department is to ensure that the rules and procedures, established in order to achieve the objectives stated above, are strictly observed.

Why the cloud?

We have been procuring cloud services from commercial clients since 2008 to increase our computational & storage resource capabilities. In 2011, our organisation joined an international initiative setting up a federated cloud marketplace for science with the aim of making our data available to different communities who could upload their data and IPRs on the cloud and therewith use our data in new contexts. Cloud would allow our users to find data, peers, IPRs to create jointly values (science & business).

How we procured cloud services

Commercial Procurement actions

We have been procuring cloud services from commercial clients since 2008. The budget authority, in many cases the

cost centre, delegates the implementation of the departmental and project objectives to a project manager who defines the technical specifications and budget. Once finalized, the procurement office starts the procurement procedure. This procedure works very well due to the fact that our organisation has strong technical skills in cloud computing and a skilled procurement office that has been able to deal with the aspects related to cloud computing.

Procurement from a federated cloud marketplace

In 2011, our organisation joined an international initiative to set up a federated cloud marketplace for science. Our end-goal was to make our data available to different communities who could upload their data and IPRs on the cloud and use our data in new contexts. Cloud would allow our users to find data, peers, IPRs to create jointly values (science & business). A standard frame contract scheme was used for this. This contract specifies the procurement of services, rather than technical tasks. Currently no purchases have been made via the existing service contract.

- » Looking to the future we have identified both short-term and long-term actions. Short-term actions are related to the negotiation of appropriate terms and conditions with the cloud marketplace operators and to further procurements to explore data-intensive applications. In the long-term we plan to take part in joint procurement actions as they can reduce the cost of developing specifications & contracts and improve purchasing conditions due to combined capacity.

What we learned

What worked well:

- » Our well-established procurement process works well for cloud procurement.
- » Competences required to write the ITT/RFQ are present.

However, some procurement areas specific to the cloud are yet to be defined, such as bringing the instrument data into context with IPRs allowing the transformation of data into information on the cloud.

- » Service contracts based on KPIs are the best way to procure cloud services. The frame contracts request services instead of detailed technical specifications and allow a very easy implementation of cloud services.
- » The definition of service specifications has always been facilitated by the fact that our organisation mainly procured IaaS. There is not the same level of confidence for SaaS/PaaS and this is why we joined the partnership to establish a federated cloud marketplace for science.
- » The monitoring of the provided cloud services is done through an in-house system.

What didn't work well:

- » A new procurement scheme is required to delegate cloud resources to our user communities, for their own purpose.
- » Our community (the majority are from Europe & US) is not prepared to allocate parts of their research grants to use cloud computing. The research procurement systems in place are designed to specifically support IT procurement, rather than procurement of IT services.
- » In service procurements we can not specify how the service is being performed, but only what is being delivered (KPIs). Since most scientific environments maintain their own IT environment, cloud computing as-a-service is a difficult environment to procure services for, in particular estimating the associated costs.
- » Accounting of cloud resources and comparing costs.
- » It is difficult to establish a procedure to enable a dynamic interaction of shared data and IPRs which caters for distribution of profits made from cloud services amongst partners. This is due to the procurement process being based on a publicly funded R&D model.
- » Cloud marketplaces still require further development and a standard legal and contractual framework is required.

Wish list:

- » We would like to set up a new ecosystem based on a federated cloud allowing the dynamic establishment of value chains delivering information (science and/or business). The open exchange of thematically related value chains allows the creation of thematic environments supporting interactions, which in a rigid project structure would not arise.
- » The ecosystem can become the reference point for the science and private sector community driving the future R&D and industrial initiatives in Europe.
- » Industry bringing data & IPR in a commercial environment and making profit would need to provide financial feedback to the data and IPR providers. A financial accounting system beyond IaaS would be required for this.
- » Harmonisation of procurement schemes of the European public research organizations, will help in getting a marketplace started and reach a critical mass. Demand-side agencies have a large European and global science community being affiliated to their data. Based on the experience of these agencies other agencies could gradually be integrated.
- » A contract template for cloud services, a transparent catalogue of services and a catalogue of cloud service providers.
- » A standard legal and contractual framework for cloud marketplaces.
- » The procurement process that we envisage for the cloud marketplace reflects the one adopted by App Stores or Playstore. The value offering are data, tools, and always new IPRs.
- » The presence of an independent cloud broker at all levels (e.g. IaaS, SaaS, PaaS, skills brokerage, Information brokerage). This should speed up the purchase from a cloud marketplace.

4. Reducing the cost of developing specifications & contracts while improving purchasing conditions are the main challenges for public research organisations

The Procurer	Intergovernmental organization
Type of procurement approach	Commercial Procurement
Geographical coverage of the procurement	European
Cloud services procured	IaaS (primarily CPU capacity with cache storage)
Users	Researchers
Scale of the procurement	<€48,000
Actors involved in the procurement process	1 Project Manager, 1 IT Manager, 1 Procurer
Procurement Outcomes	Successful procurement

The procurer

We are an intergovernmental organization with 21 member states. Member states have special duties and privileges, contributing to the capital and operating costs of our programmes. Our mission is to enable international collaboration in scientific research. At present more than 11000 scientific users from research institutes all over the world are using our installations for their experiments.

We purchase goods and services according to our procurement rules. Contracts or orders are awarded to suppliers or service providers following a selective procurement procedure. This is divided into two categories as described below.

- » Price enquiries: for contracts below the value of €190,000, we send a price enquiry to companies we have selected by. These companies are encouraged to register in our suppliers' database and indicate their core activities.
- » Invitations to tender: for contracts above the value of €190,000 companies must participate in a market survey. Companies receive the market survey if they are already registered in our suppliers' database or in contact with the relevant procurement officer or technical contact. Alternatively, relevant documents can be downloaded from our market surveys and calls for tender page. Based on the results of the market survey, our organisation selects companies that meet the tender requirements before inviting them to tender.

Our Procurement rules define two adjudication principles: "lowest compliant" or "best-value-for-money" for service contracts. The adjudication basis is specified at the market survey stage. The country of origin for supplies and services is restricted to our member states, unless stated otherwise in the contract.

Why the cloud?

We need cloud computing resources to provide additional capacity for researchers while keeping costs at a competitive level compared to in-house solutions.

How we procured cloud services

In 2014, we performed a cross border procurement of cloud computing resources to provide additional capacity for researchers. The procurement action was defined with three main objectives in mind:

1. To test the suitability of our organisation's procurement process for commercial IaaS;
2. To track the evolution of the commercial IaaS compared to in-house costs;
3. To obtain acceptable contractual terms and conditions.

The first two steps of the procurement action were the definition of the procurement objectives and of the IT requirements. The main procurement requirements defined by the project manager were a good balance between price and performance and accurate billing. The main IT specifications were a service availability of 99.5% and the network access via a public provider.

The overall amount of the procurement action was less than €48,000 and therefore a market survey procedure was not necessary.

To identify the most suitable cloud service provider a price enquiry was prepared outlining the technical specifications based on the experience we had gathered through a previous pilot phase. This was then sent to a number of selected suppliers.

The selection criteria were uniquely based on the lowest cost response to a price enquiry document including a technical specification and service definition.

A total of 5 suppliers answered the price enquiry and at the end of the evaluation process phase one provider was selected. The selection was based on the provider who could meet the technical specifications at the lowest cost. Only one supplier was required due to the limited scale of the procurement action and because business continuity was not an issue. Following this, our organisation signed a purchase order with the supplier.

The full procurement process took three months. The experiment's workflow management system, for which the procurer was sought, has a built-in monitoring system which is used to measure usage and performance.

In 2015 we intend to make further procurements to explore data-intensive applications. We have submitted a proposal with other research laboratories across Europe in the context of the H2020 PCP/PPI actions for future joint procurement activities.

As long-term action, as we are targeting IaaS, we envisage an open cloud marketplace as the framework to buy cloud services in the future. An open marketplace could enable a large choice of providers with competitive prices, even if currently they are still immature.

What we learned

What worked well:

- » Given the skills and the high expertise of our IT staff in cloud computing the price enquiry technical specifications were relatively easy to define
- » The definition of technical specifications was facilitated by the fact that we were procuring IaaS. There is not the same level of confidence for SaaS/PaaS for which technical specifications, which are vendor neutral, are difficult to define.
- » An in-house system was used to monitor the performance of the procured services
- » Buying IaaS, combined with an independent performance test, is similar to purchasing traditional ICT goods. The suppliers' offers were easy to understand in terms of the proposed pricing.

What didn't work well:

- » In a first iteration only one supplier met the technical specifications which was not acceptable to our procurement office. The price enquiry was therefore reissued with a broader specification.
- » Some suppliers had questions linked to the tendering material concerning testing, monitoring & network access via the public provider.
- » The full procurement process was time consuming mainly because the purpose of this procurement action was to use our organisation's procurement model to understand if it is suitable for the cloud services. Previously our organisation had successfully performed procurement of cloud services in a couple of days for smaller values (<€4,800). The procurement process was shorter if compared to an equivalent purchase of traditional ICT resources (a typical large-scale H/W procurement cycle for our data centre usually takes about 1 year from start to finish).
- » The main barrier that we had to overcome was developing a standalone test that could be used to verify the suitability of the services offered by the suppliers.
- » A standard contract template for cloud services does not exist so analysis of the different offers proved to be time consuming.

Wish list:

- » A contract template for cloud services,
- » Transparent catalogue of services
- » Catalogue of cloud service providers.

5. Going towards a university which is 100% in the cloud

The Procurer	University
Type of procurement approach	Commercial procurement
Geographical coverage of the procurement	European and national
Cloud services procured	Mainly IaaS
Users	Students & university departments/employees
Scale of the procurement	On a central level, we have so far moved <10% of our ICT services to the cloud
Actors involved in the procurement action	Head of IT, Technical officers, procurers
Procurement Outcome	Several procurements completed

The procurer

We are a university which strives to develop interaction between research, education, collaboration and innovation that challenges boundaries.

The procurement of ICT services is usually initiated by the head of IT with the support of the technical team (for the definition of the IT specs) and the procurers. They are responsible for the services that are purchased while the procurers are responsible for legal aspects. Usually larger purchases are carried out through an open bid. The bid is submitted to the procurers before its publication. The vendors usually have 40 days to respond.

As a university, we comply with the computer laws. The vendor must have a Service Level Agreement that we can accept. Criteria used to evaluate tenders typically includes pricing and functionality requirements. Confidence in suppliers and regulations are also considered.

Why the cloud?

Cloud procurement of SaaS, IaaS, PaaS is not just moving from an IT solution to another. Rather it is about rethinking the applications that you currently run or adopting new services. We needed cloud to implement a cost-effective service for file sharing between different user clients and collaboration with others users, administrated by our university, to provide our institute with additional resources and to provide more agile services to our students.

How we procured cloud services

Our university has a long experience of procuring cloud services. The three examples provided below show different approaches to the procurement process and adoption of cloud services.

1. A central body conducts the procurement and produces an agreement that different departments can use to access the services.
2. A joint procurement action between some universities where one university (one partner) carries out the procurement for the other institutions.
3. No procurement at all. This method can be used when no money transfer is involved. A lot of no-cost cloud services

exist and users access them with no central control.

In the future, we aim to move more of our IT-services to the cloud. As a further step, we would like to try procurement of public innovation (PPI) as we intend to buy services that do not currently exist. Suppliers are encouraging us to do this in order to push innovation initiatives. Elastic cloud services are an ideal working test bed for such approaches.

Procurement action #1: Moving to a controlled collaboration service together with all national universities

One of the first controlled cloud procurement actions was to purchase a cost effective service for file sharing between different user clients and collaboration with others users, administrated by our university. The national universities asked a single entity, the national university internet supplier, to perform the procurement of a service for staff and students. The overall procurement process took six months to complete. We also carried out some initial testing and requirements gathering. A pre-market analysis was then performed and an open tender was published reflecting the scale of the procurement action (<€1 million per year).

The main criteria for selecting the supplier were price and functionality, with the solution selected meeting these two requirements. A 4-year agreement was signed and no major issues were encountered in buying the service. Client and sync support was also negotiated in this process. The services are currently monitored through our admin console. The solution selected means that staff do not use un-procured cloud storage services such as Dropbox and provides the administration of 2,000 accounts. Universities can now deploy the solution at their institution and all legal issues are handled once by national university internet supplier.

One of the major success factors of this procurement action was the collaboration between universities and the national university internet supplier. In particular, the fact that legal issues for all universities were managed by them.

Procurement action #2: Joint procurement with identified cloud provider

In this case we lead a joint national procurement process for four universities in our country. We were able to procure the solution through a joint Academic Agreement with the cloud

provider which brought a substantial price reduction for all. The procurement action took six months. There was no need to define technical specs or to run a market analysis as the target of the purchase was clear. The selection of the supplier was conducted mainly on the basis of price and monitoring service modules available.

The service was purchased through an open bid (the overall scale of the procurement was <€1 million).

One problem encountered was that no formal answer to the tender was received. This was because the role of the selected cloud provider and the relationship between the institutions was not clear. This transformed the open tender in a negotiated agreement.

We purchased services for 1 year to be extended annually over a 4 year period. No problems were encountered with the supplier's SLA and we were able to negotiate the agreement. We currently monitor the performances of the service through a cloud provider monitoring system. Since the formal closure of the tender, the process has run smoothly.

Procurement action #3: Procurement without tender

A number of years ago we sought collaboration tools and student/staff e-mails. Internally, we assessed the technical requirements and based on this investigated the market.

We identified two solutions which were both free of charge for universities. No open tender was required as no payment involved. Nevertheless, we did hold discussions with the providers regarding the suitability and adoption of their services. The overall procurement process took two months for each service.

The main selection criteria for the suppliers was based on the Data Processor Agreement. This was also the main point of discussion in the service negotiation.

The services procured are still on-going and with no set duration. The services can be terminated by the procuring organization by merely sending a notification of service termination. The monitoring of the service is done through an admin console.

The procurement process was extremely successful. The main barriers that we had to overcome regarded the legal implications of the Data processor Agreement.

What we learned

What worked well:

- » Joint procurement saved a lot of time.
- » Joint procurement offers a larger negotiation with the vendor.
- » If joint procurement is applied carefully, legal matters as Data Processor Agreement negotiations only have to be carried out once.

What didn't work well:

- » In one tender we did not receive any bids due to confusion about underlying cloud service restrictions and monitoring tools.

Wish list:

- » A powerful costs monitoring system to correctly allocate costs within the cloud services. When we buy cloud services we have to make sure that we can allocate the costs to different cost centers. We must be able to split the invoice internally to departments, projects, etc.
- » The cloud vendor should be transparent and proactive. One negative experience of this was when the cloud provider was out of service. No communication from the cloud provider was received on this. We found out the service was down from a blog.

Recommendations:

- » Ease and timing of procurement are the most important aspects.
- » Legal aspects and Data Processor Agreement is fundamental for procurement by public entities.
- » Ensure that you have an exit strategy when you move to the cloud.
- » Restricted procurement for us is risky because the selection of suppliers can be complex. In the case of a supplier contesting selection, this could go to court.
- » Marketplaces are problematic because a framework agreement doesn't exist
- » As a university we comply with the computer law and the vendor must have a SLA that we can accept. For instance, some large providers have problems with this because they use data for commercial purposes and this is unacceptable for our university.

6. Cloud for social media

The Procurer	European National library
Type of procurement approach	Commercial procurement
Geographical coverage of the procurement action	European and national
Cloud services procured	IaaS
Users	Students & university department/employees
Scale of the procurement	Cloud services provided to one department
Actors involved in the procurement action	Head of IT, Technical officers, procurers
Procurement Outcome	A test is ongoing

The Procurer

We are a European National Library. The institution holds more than 4 million volumes and subscribes to 26,000 periodicals and journals. In addition, we provide a collection of Open Access documents on the internet with free access to 60,000 articles and working papers. A further portal we run is for students and researchers to search among nine million datasets. We employ a staff of 250.

We are currently also involved in a research alliance of 37 partners (institutes, university-affiliated, and independent research institutions) investigating the impact of Science 2.0 (the use of modern internet technologies in all stages of research). The Alliance brings together both stakeholder groups crucially affected by Science 2.0 – the library community and the scientific community.

The procurement of ICT services is usually initiated by IT managers that are responsible for the services. The form of procurement varies depending on the nature, cost and complexity of the item(s) to be purchased. As a public funded body, we have to procure ICT goods and services ethically, fairly and transparently in line with the national and EU legislation. Generally, the higher the purchase costs are, the more formalized and extensive the procurement process is, e.g. direct procurement, formal asking for at least three quotes, public announcement and full EU tender process.

Why the cloud?

We are currently in the process of adopting cloud computing solutions for our social media department. This is the first experience of using cloud computing for the institute. The need matured mainly within the community management of the social media department and within the context of the Science 2.0 research alliance. The main drivers for us is having unlimited and flexible storage capacities and the possibility to share content easily and with external partners.

Currently, our employees are using individual solutions whose storage is often located in the United States. However, this cannot continue as national and European data privacy law forbids us to put personal data in servers outside the EU. Setting up our in-house cloud solution would allow us to overcome this problem and also address the data constraints that we have for some datasets.

Our main concerns for cloud adoption are related to data

privacy and data security. For this reason we opted for a private cloud which lets us maintain a certain control over data and the full infrastructure.

How we procured cloud services

As this is the first time we have procured cloud services, we have decided to start small by running a pilot phase to test the cloud solution and understand the benefits (both performance and economics). The pilot phase will substitute the business case analysis as we currently do not have the necessary experience to carry out such an analysis for cloud solutions. Initially, the cloud solution will only be implemented and tested by the social media department.

We carried out an internal consultation of the market, identifying solutions suitable to our needs. We initially compared prices of different suppliers for external storages. No procurer or legal expert was consulted given the small and local size of the procurement action. However, this activity was difficult as we observed that suppliers have different approaches on storage.

We then compared open-source solutions to set up an in-house/private cloud storage. After having identified a pool of suppliers, we started testing different solutions. This was a difficult process, in particular testing functionalities of open source solutions which do not provide test environments.

After testing, we adopted an open source cloud solution. The main reason for this was the competitive price that was available to us. One service we sought, a cloud-based collaborative tool to enable our users to work on a shared text document, was not found.

Our plan now is to set up our in-house environment.

What we learned

Main benefits envisaged in adopting cloud

- » More flexibility.
- » Availability of additional resources.

Main barriers perceived in procuring cloud services

- » Data Security.
- » Data privacy management

Main challenges encountered so far

- » Lack of internal experience of writing a business case for cloud solutions. Therefore, a small test case was carried out.
- » Comparing different storage offerings was difficult because

different cloud service providers have different storage approaches.

- » Testing open source solutions was challenging due to a lack of test environments.
- » A supplier that provides cloud-based collaborative tools to work on a text document was not identified.

Wish List:

- » Sample templates and guiding graphs to make public tenders would help us to speed up the procurement process

7. Taking EU institutions to cloud service adoption through an open tender

The Procurer	European Funding Agency
Type of procurement approach	Joint commercial procurement
Geographical coverage of the procurement action	Europe and Associated Countries
Cloud services procured	IaaS, PaaS
Users	EU institutions
Scale of the procurement	>25M€
Actors involved in the procurement action	Head of IT, Technical officers, procurers
Procurement Outcome	20 offers received

The Procurer

We are the department of a European funding agency in charge of delivering digital services to enable EU policies and to support the funding agency's internal administration. We have the responsibility to:

- » Provide European institutions and bodies, with high quality and innovative: workplace solutions (creating new ways of working and collaboration for staff), business solutions (delivering information systems supporting rationalised business processes within the framework of the corporate IT Governance strategy), infrastructure solutions (providing reliable, cost-effective and secure infrastructure and services), effective solutions (aligning IT investments with business priorities, facilitating relationships with our strategic partners, balancing risk with business value for the Institution);
- » Support the modernisation of public administrations by promoting and facilitating interoperability so that European public administrations can work seamlessly together across boundaries.

Why the cloud?

We are currently in the process of procuring cloud services to acquire the necessary resources to serve different institutions including EU Institutions, Executive Agencies and Bodies. This is the main reason why we decided to go for an interinstitutional call for tender.

How we procured cloud services

The Call for Tender was launched on December 27th 2014. The call for tender was divided into 3 lots:

- » Lot 1: Private Infrastructure as a Service (IaaS): compute and storage facilities hosted by a single provider connected to the EC datacentres by a dedicated private network link;
- » Lot 2: Public Infrastructure as a Service (IaaS): compute and storage facilities offered over the public Internet;
- » Lot 3: Public Platform as a Service (PaaS): more than just storage and compute facilities, this lot also includes operating systems and/or database services built upon Cloud infrastructure.

The call imposed that all data and infrastructure were deployed on European Union territory only, for essential security and data protection reasons and to be compliant with EU data handling requirements.

The award decision for the first Call for Tender for Cloud Services was signed in January 2016.

Overall 20 offers were received from 12 tenderers: 7 offers for Lot one, 9 offers for Lot two and 4 offers for Lot three. The call for tender generated a significant interest, with more than 3000 downloads of the specifications and more than 450 questions asked by potential bidders.

Contracts have been awarded to:

- » Lot 1: Private Infrastructure as a Service (IaaS) - BT Limited Belgian Branch;
- » Lot 2: Public Infrastructure as a Service (IaaS) - BT Limited Belgian Branch, IBM Belgium, Accenture, Cloud Team Alliance, ATOS;
- » Lot 3: Public Platform as a Service (PaaS) - Telecom Italia, Accenture, ATOS Belgium, IBM Belgium.

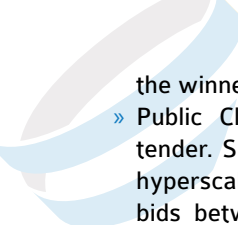
The maximum financial volume of the resulting contracts over a maximum of four years are 10,252,762.00€ for lot one, 13,946,625.00€ for lot two and 10,360,350.00€ for lot three.

Next steps

The Call for tender will allow the deployment of a first set of IT services in the Cloud during 2016. A series of use cases are studied and should be deployed in the coming months.

What we learned

- » Private Cloud: Established datacentre providers answered this lot (4 EU companies and 3 US companies). All technological stacks provided are technologies coming from US companies exclusively. This Lot introduced a significant constraint to have dedicated link between the customer and the provider, which explains the significant presence of Telecom operators that are also datacentre providers. No hyperscale providers (almost fully automated with a huge installed base of servers) made a bid for Lot 1, the size of the award being too small for such operators. The received offers for Lot 1 were technologically comparable; therefore



the winner was the provider offering the best price.

- » Public Cloud: Layers of services were required in the tender. Such services are not available in the catalogue of hyperscale providers. Thus the offers received were joint bids between hyperscale and other market players able to provide more differentiated services. The re-opening of competition mechanism for each specific contract did not prevent participation in Lot 2 (IaaS). Awards for this Lot have been driven by the quality of the offers instead of the prices. Only hyperscale providers with partner companies participated in Lot 3. Different conclusions can be drawn:
 - » the PaaS market does not appear as mature as the IaaS market;
 - » only large vendors have the human resources to bid for this kind of tenders (no SMEs)
 - » the procurement process for PaaS is something that doesn't match well with the traditional procurement procedures.

8. Joint procurement for cloud brokerage services

The Procurer	20 European agencies
Type of procurement approach	Joint commercial procurement
Geographical coverage of the procurement action	Europe and Associated Countries
Cloud services procured	Cloud Brokerage Services
Users	EU institutions
Scale of the procurement	65M€
Actors involved in the procurement action	N.A.
Procurement Outcome	The tender is currently open.

The Procurer

We are an agency funded by the European Union that operates independently of the European legislative and executive institutions (Commission, Council, and Parliament) and EU Member States.

Our agency was set up in 2002 to be a source of scientific advice and communication on risks associated with the food chain. The agency was legally established by the EU under the General Food Law - Regulation 178/2002.

The General Food Law created a European food safety system in which responsibility for risk assessment (science) and for risk management (policy) are kept separate. Our duty is to communicate our scientific findings to the public.

Why the cloud?

In line with the European Cloud Computing Strategy adopted by the European Commission, many EU Agencies see 'cloud services' as the next primary way in providing information services. Cloud based services offer the possibility to add agility and flexibility in developing and rolling-out new ICT services, avoiding buying additional data centre equipment, while reducing Capex and Opex expenditures.

How we procured cloud services

In order to be able to procure the cloud based services swiftly as and when needed the contracting EU agency decided to establish a dedicated single framework contract.

The cloud market is rapidly evolving and highly transformational in many aspects. To allow the necessary flexibility in such an evolving environment, in addition to opt for a framework contract, it was decided to base the contract on a "Cloud Service Broker" (CSB) model approach.

As the EU agencies face the same needs and expectations in the cloud service market, in order to optimise the use of EU public funds, it was decided to pool resources and launch the call for tenders as a common initiative of several EU agencies. Accordingly, this call is being launched as an interagency procurement, under the lead of the lead awarding authority. All the other EU agencies have joined the interagency call and will also use the resulting framework contract.

The Call for tenders is based on the lead awarding authority Work Programme for grants and procurement. The purpose of

the call for tenders is to establish a supply channel for multiple types of cloud services (multi-sourced) through an external cloud service broker.

The call objective is to award the framework contract to an entity, the Cloud Service Broker (CSB), acting as intermediary and aggregator of services provided by different cloud service providers.

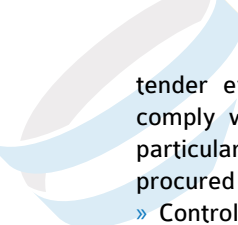
The CSB shall be able to:

- » 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 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,
- » provide a self-service Cloud Management Platform (CMP) to:
 - » present, purchase, provision, monitor and manage cloud resources,
 - » provide a centralized, 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 specialized 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.

The tender was published in January 2016. The time limit to receive tenders is 1st April 2016.

What we learned

- » Drafting the minimum requirements that must be complied by the bidders could be an efficient way to speed up the



tender evaluation. If the bidder cannot state that they comply with these points then their bid is eliminated. In particular, the requirements included in the tender for the procured broker service are:

- » Controlling of personal data processing performed on behalf of the EU o Respect of data subjects' rights & data quality principles
- » Territoriality of datacentres
- » Data transfers outside EEA
- » Sub-processing & audits
- » Personal data breaches
- » Recognition of Protocol of Privileges & Immunities applicable to EU institutions and bodies for what concerns access of law enforcement bodies o Data portability and erasure
- » Contractual remedy
- » Information Security
- » Some other technical interesting points from the tender documentation are:
 - » The number of points that can be awarded for each criteria are listed together with conditions under which maximum or minimum points will be awarded
 - » Financial penalties are defined for non-respect of service quality, such as non-availability of the service, erroneous invoices, slow response from the service desk etc.
 - » The financial stability and minimum turn-over of bidders will be checked (this is in contradiction with the EC's policy of promoting SMEs)
 - » Connection to GEANT is explicitly listed under network connectivity
 - » The roles of software architects, programmers, analysts, network engineers and their hourly rates are listed

9. A commons cloud credits business model to support and facilitate sharing and reuse of digital objects

The Procurer	Biomedical research agency
Type of procurement approach	Cloud credits procurement model
Geographical coverage of the procurement action	National
Cloud services procured	IaaS, PaaS, SaaS
Users	Organisation employees, Communities interested in the data of the procurer
Scale of the procurement	N.A.
Actors involved in the procurement action	Investigators, Resellers
Procurement Outcome	The test of the cloud credits business model is currently ongoing

The Procurer

We are a biomedical research agency based in the United States. Our mission is to seek fundamental knowledge about the nature and behaviour of living systems and the application of that knowledge to enhance health, lengthen life, and reduce illness and disability.

The goals of the agency are:

- » to foster fundamental creative discoveries, innovative research strategies, and their applications as a basis for ultimately protecting and improving health;
- » to develop, maintain, and renew scientific human and physical resources that will ensure the Nation's capability to prevent disease;
- » to expand the knowledge base in medical and associated sciences in order to enhance the Nation's economic well-being and ensure a continued high return on the public investment in research; and
- » to exemplify and promote the highest level of scientific integrity, public accountability, and social responsibility in the conduct of science.

Why the cloud?

In our vision to speed up the scientific discovery, a shared virtual space where scientists can work with the digital objects of biomedical research, i.e. to find, manage, share, use and reuse data, software, metadata and workflows is needed. Such a system is what we call a "Commons". A commons is a digital ecosystem that supports open science and leverages currently available computing platforms in a flexible and scalable manner to allow researchers to transparently find and use computing services and tools they need, access large public data sets and connect with other resources associated with scholarly research (e.g. GitHub, Zenodo, ORCID, Figshare, journal publishers etc.). Such a system must be adaptable to the different and evolving needs of research communities as well as the evolving technology innovations. Components of the Commons ecosystem include:

- » A computing environment, such as the cloud or HPC (High Performance Computing) resources, which support access, utilization and storage of digital objects.
- » Public data sets that adhere to Commons Digital Object

- Compliance principles.
 - o Software services and tools;
 - » Scalable provisioning of compute resources.
 - » Interoperability between digital objects within the Commons.
 - » Indexing and thus discoverability of digital objects.
 - » Sharing of digital objects between individuals or groups.
 - » Access to and deployment of scientific analysis tools and pipeline workflows.
 - » Connectivity with other repositories, registries and resources that support scholarly research.
 - o A set of Digital Object Compliance principles that describes the properties of digital objects that enables them to be findable, accessible, interoperable and reproducible (FAIR).



Figure 3: Commons framework

Clouds are increasingly being used as a computing platform by biomedical researchers because they afford 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 and cost of individual investigators independently moving these data sets to cloud, enable the ability to compute against data sets and permit new and novel uses across data sets. Adherence to a digital object compliance model will be essential in order to make these data sets indexable and easily discoverable.

Easily finding, deploying, linking and using computing services

and analytical tools/workflows will promote rapid and flexible scientific discovery in the Commons and will make it easier for those with more limited computational skills to utilize the environment.

How we procured cloud services

At its foundation the Commons framework requires a computing platform that, in its initial iteration, will be implemented using a federation of public and private computing clouds and other capable compute platforms, e.g. university and national laboratory high performance computing (HPC) resources.

As only a limited number of investigators today have access to such resources, it will be necessary to facilitate access to them in order to fully evaluate their use. That's why we started testing a Cloud Credits Pilot, which is a business model to support the use of cloud computing for the Commons.

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.

The cloud credits business model is shown in the Figure below:

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 incentivized to use their credits efficiently and cloud providers are incentivized to provide better services at the lowest possible price.

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.

Next steps:

The research agency is currently 3 months into a three year pilot to test the efficacy of this business model in enhancing data sharing and reducing costs. In this pilot the research agency 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 Figure 4).

What we learned

Advantages of this model:

- » Supports simplified data sharing by driving science into publicly accessible computing environments that still provide for investigator level access control
- » It is scalable for the needs of the scientific community for the next 5 years
- » Democratizes access to data and computational tools
- » It is cost effective:
 - » Creates a competitive marketplace for biomedical computing services;
 - » Reduces redundancy
 - » Uses resources efficiently

Potential disadvantages:

- » Novelty: This model has never been tried, so we don't have data about likelihood of success
- » Cost Models: Predicated on stable or declining prices among providers. True for the last several years, but we can't guarantee that it will continue, particularly if there is

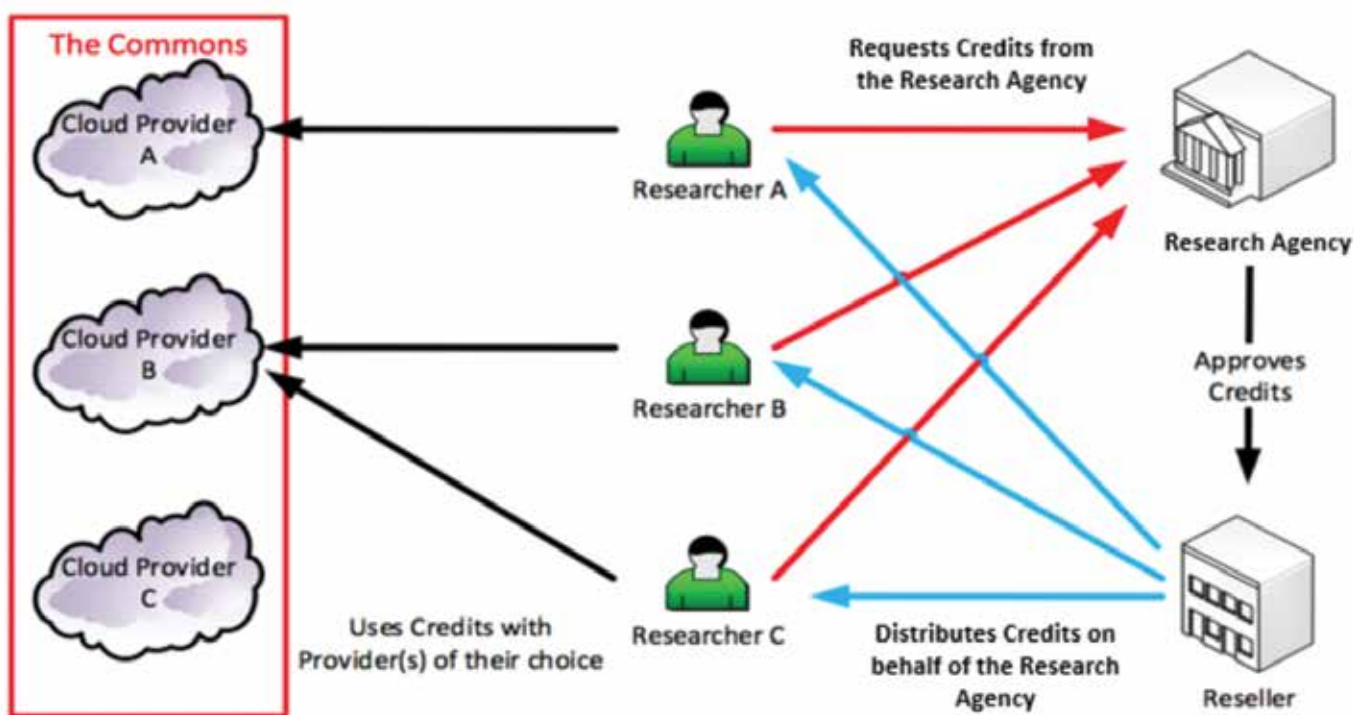


Figure 4: Commons Cloud Credits Business Model

significant consolidation in industry of Service Providers: Predicated on service providers willing to make the investment to become conformant. The market research suggests 3-5 providers within 2-3 months of program launch.

- » Persistence: The most significant disadvantage to this model is that it is pay as you go; that is, 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.

Piloting

- » The use of a relatively small number of providers, coupled with a single reseller distributing credits provides the research agency with an opportunity to assess the usage of digital objects that are being supported and maintained in the Commons.

Having general service provider conformance requirements is fundamental to streamline the management of the full model:

- » In this model six areas for minimum requirements have been identified: Business relationships (coordinating centre, investigators); Interfaces (upload, download, manage, compute); Capacity (storage, compute); Networking and Connectivity; Information Assurance and Authentication and authorization.

» Some examples of requirements are listed below:

1. A conformant cloud is not necessarily a provider of Infrastructure as a Service (IaaS) although all providers must provide IaaS.
2. Resellers: A reseller of services can act as a conformant provider so long as the provider upon which they operate their service layer is able to meet the conformance requirements.
3. Credit Distribution Model: The provider must accept the financial mechanism by which the Government intends to deliver payment and to provide monthly on pre-defined and mutually agreeable reporting of Commons user metrics for those utilizing their services.
4. General access considerations: In order to be part of the Commons, Providers must make their services available to the broad research community. Thus, a cloud that is inaccessible outside of that organization will not be considered conformant, since it does not make the digital objects contained within that cloud available to the broad research community.
5. Business relationships and liability: Digital Object Stewards and other investigators that interact with the Commons will do so under a business relationship with the Provider(s); the government will not be a party to these agreements. Similarly, the government and Providers will not participate in a direct relationship for the purposes of the distribution of resources; rather resources will be distributed and managed by a third party (the coordinating centre) with whom the government will have a contractual relationship. The government therefore accepts no liability for the actions of investigators in the Commons.



Four organisations investigating how to procure cloud services

1. Tearing down barriers to cloud adoption

Who we are

We are an international organization with just under 200 member nations and present in over 130 countries.

Our procurement process is based on the fundamental principles of best value for money, fairness, transparency, economy and effectiveness. It is based on a formal contract award procedure which follows a competitive procurement process. Participation in the solicitation process is only open to vendors that are registered to the UN Global Marketplace (UNGM) via the vendor registration portal. The invitation to vendors depends on the company's experience, its ability to perform, financial soundness and the relevance of the goods, works or services offered. All suppliers working with us must accept and abide our General Terms and Conditions for Goods or Services.

Depending on the value of the procurement action, methods of solicitation may include:

- » Very Low Value Procurement
- » Request for Quotation (RFQ)
- » Request for Proposal (RFP)
- » Invitation to Bid (ITB)

For procurement of ICT services, our IT department functions as a consultant in order to support actors in the smooth running of procedures. Usually, in a procurement process of ICT services the initiator of the procurement action works in close collaboration with the IT department, the legal officer and procurers to make sure to cover all the aspects of the procurement process.

Why the cloud?

The main benefits that we envisage in adopting cloud services are:

- » Cost savings in our data centres through outsourcing resources
- » Increased flexibility by acquiring additional capabilities needed to manage big data, especially when it comes to satellite data.

Main barriers perceived in procuring cloud services:

- » Security of cloud solutions: moving data to a commercial provider is risky from a privacy and security perspective. We manage sensitive data that cannot be publicly disclosed. To overcome this barrier we developed an information security risk assessment for each cloud solution that we have through which the IT division can make an assessment of the cloud providers and also provide guidelines on procurement. However, diffidence still remains.
- » Data privacy management: another concern which is strictly related to data security regards the legal framework, in particular to data protection. As part of an intergovernmental organisation, data stored by them cannot be accessed by local governments. Cloud service providers need to guarantee this.
- » Due to the cross-border nature of our organization, we are unclear which laws in which country are applicable to data and cloud solutions
- » Procurement of on-demand services is also an issue as traditionally the purchase is at a fixed price. This is very different to pay-per-use services where you have monthly invoices with different amounts. Policies are not in place to address this issue.

We have a well-defined procurement process that works well and our legal, procurement and our IT in-house staff are sufficiently skilled to procure cloud services.

We do not have any experience of pure procurement of cloud services. However, we are very interested in moving towards cloud adoption and our IT department is encouraging this. Until now we are using the cloud in a limited way.

Although we are pushing towards cloud adoption, the next steps depend on the above mentioned policy issues. Unless our internal policy changes, it will be difficult to purchase cloud services.

2. Approaching cloud through a pilot test

Who we are

We are an independent intergovernmental organization providing a weather forecasting service and weather data catalogue to 34 countries (member states) and commercial clients. We also provide computing resources to the meteorological user community. We have a supercomputer facility (and associated data archive) which is one of the largest of its type in Europe.

Our procurement process is designed to achieve both quality and value for money in the procurement of goods and services. We use an open tender process and as an international organisation, we are governed by our convention and its associated financial regulations. Where the contract involves an amount exceeding €210,000, invitations to tender have to be made public in the countries that the centre serves, unless the nature of the contract or special circumstances justify an exception. In the case of goods or services which, because of their nature or amount, cannot be the subject of a public invitation to tender, the Director General of our organization may ask a restricted number of specialised contractors from as wide a selection of countries as possible to submit offers. Contracts shall be concluded following adjudication or requests for tenders.

Contracts may also be concluded directly:

- » where the contract involves an amount not exceeding €210,000 for supplies, services and for scientific and technical equipment and construction work;
- » where goods and services are so urgently required that it is not possible for either of the tendering procedures;
- » where tendering or invitations to tender have produced no results or where the prices quoted are not acceptable and where a repeat invitation to tender is not expected to produce a better result;
- » where for technical, practical or legal reasons the services can only be rendered by a specific contractor or supplier;
- » where supplies, services and scientific and technical equipment and construction work are purchased through frame work agreements that have been established by public procurement agencies which select suppliers via a tendering process which complies with EU procurement rules.
- » Where the expected value of services for a single indivisible unit does not exceed €4,200 a contract may be placed against bill or invoice only, under the conditions laid down by the Finance Committee.

Why the cloud?

We have a large supercomputing facility hosting at present two Cray XC-30 supercomputers used mainly for running 24x7 operations to generate medium-range weather forecasts for our member states, for research, and to provide computing resources to the meteorological user community.

Our global weather model and related software produces millions of products on a daily basis. The products generated are highly customized to the individual requirements of our users and are transferred to their home sites either via private networks or via the Internet.

The number of products generated is not only high in number but also some of the products have very large volumes in the order of terabytes of data. The transfer of these very large data-sets to our customer's home sites is not always feasible especially when having strict time delivery constraints for 24x7 operations. A solution is to run the user processes on computing resources close to where the data-sets are stored. To implement this solution we have two options. Either we build a private cloud in our data centre and offer the resources to external users from other organizations, or we establish a partnership with a public cloud provider connected to our organisation with a high bandwidth network link such that the data is stored directly on the cloud. External users from other organizations could then use cloud computing resources from the same provider to post-process the data and generate their own output and products.

As a second use case, we are also a research centre that maintains one of the world's largest archives of meteorological data. This multi-petabyte archive is available for research purposes and it is envisaged that a subset of the most important data-sets with a total aggregated volume between two and three petabytes could be made accessible to a much larger scientific community using cloud technologies. These data-sets are useful not only for meteorological and climate research but also in many other scientific fields, as an example, models for the spread of malaria in Africa benefit greatly from having access to this type of meteorological historical data.

As yet we have not procured any cloud computing services.

Our main perceived barriers are a lack of information on security assurance and an increased dependence on cloud service providers and vendor lock in.

- » In 2014 we joined an international initiative setting up a federated cloud marketplace for science to extend our cloud computing competences and to speed up the process of procuring cloud services. We currently plan to do a pilot test for establishing whether the performance offered by different cloud providers is sufficient for our use cases.

3. European libraries and cloud computing



Who we are

We are part of a major public research university with 11 constituent faculties, within which there are over 100 departments, institutes and research centres. We have a large library system that comprises 18 libraries located across several sites, linked together by a central networking catalogue and request system for over 2 million books. Since 2004, we have been collecting the scholarly work of internal researchers to make it freely available on the internet via an open access repository. The intention is that material we curate will remain accessible indefinitely.

As a public funded body, we have to procure ICT goods and services ethically, fairly and transparently in line with European Union and our national legislation. The overall process is dictated by the general procurement processes of our university. The procurement action is usually initiated by IT managers that are responsible for the services. Our Procurement Services is involved in advising on and overseeing all procedural aspects in the procurement process so that it is compliant with legal requirements.

The form of procurement varies depending on the nature, cost and complexity of the item(s) to be purchased. Procurement above €70,000 involves a full EU tender process.

Why the cloud?

Shifting to cloud solutions gives libraries an opportunity to save time, resources and re-allocate resources to improve service. Moving away from local storage, sharing and re-using resources to move to science2.0 (Open Science) is understood as a systemic change in the modus operandi of doing research and organising science. These are the main benefits envisaged by libraries for the cloud adoption.

This isn't to say that there aren't any risks and downfalls with cloud computing. For example, there are security issues. Some archives cannot be stored in the cloud because the cloud is perceived as insecure; there are legal issues related to the fact that we don't always know which jurisdiction's national legislation governs storage of data in the cloud and use of cloud services; and there are privacy issues associated with the nature of data – certainly some research involves medical data that bring confidentiality issues because of the sensitive nature of the data.

To date, libraries have adopted cloud storage solutions mainly to manage the day-to-day operation of the library and to manage the discovery and acquisition of material.

Our experience in joint procurement

We have had positive experiences of joint procurement actions for the purchase of digital content databases. To do that, we exploited the support of a public body whose role is to support education and research, by providing leadership in the use of information and communications technology (ICT) in learning, teaching, research and administration. Their help was fundamental to help understand the significance of new technological developments.

4. Setting a cloud strategy for the future

Who we are

We are a National Research Institute with around 1,500 researchers and employees. As a public funded body, we have to procure ICT goods and services according to national law.

The institute's IT department is responsible for identifying technical requirements and drafting specifications for the services to acquire. The legal department provides support for procurement and legal procedures.

- » For procurement actions under €90,000 the IT department can select three suppliers and request for three offers.
- » For procurement above €90,000 the IT department needs the support of the legal service department and goes through a public tender.
- » For tenders between €90,000 and €133,000 the tender must be advertised through the national public portal.
- » For tenders above €133,000, the European rules need to be followed and the institute is obliged to publish the tender at a European level.

Why the cloud?

Our institution has never procured cloud services and currently we do not have the in-house skills to carry this out. At the time of writing, we do not need to procure cloud services as either in-house solutions suffice or services are already provided by our national telecommunications network for technology, education and research. Services include e-mail, directory, instant messaging, shared calendars, task management, document sharing (cloud), video conferencing.

Having said this, we believe that cloud can reduce the cost of IT server maintenance and safety and can make data more durable. It will let us archive data properly with common standards and it can improve our data sharing system. It will also help us deal with on-the-spot requests from our researchers for the acquisition of cloud services.

However, we see a series of barriers including data security, trust and management and cultural/disciplinary uses of researchers. Data security is a high priority. We manage sensitive data which are very strategic from a policy perspective. We also have a lot of personal data collected through the periodic surveys that we perform in our research and which we cannot disclose to external organisations.

Despite these barriers, we strongly believe that to get concrete benefits from cloud adoption we need to implement a comprehensive cloud strategy. Therefore, we are currently working on a strategy for a sovereign cloud (national and beyond European). We plan to participate in the "pooling" of the services of the national telecommunications network for technology, education and research. This transition from an internal system to one which is completely outsourced will make it possible to devote key computing resources to other high-value added tasks such as data mining. We also plan to participate in the sharing of services proposed by national networks, which are involved in European networks.



PICSE Wizard: Cloud procurement made easy

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