PROCURE2 INNOVATE

Pre-commercial procurement of innovative open cloud services

Helix Nebula Science Cloud, CERN (Switzerland)

Winner of the 2019 Procura+ Outstanding Innovation Procurement in ICT award

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BACKGROUND

Large scale scientific projects require huge amounts of data storage and analysis resources. European research projects in domains such as genome analysis, astrophysics, life science and photon science need to be able to share data globally as part of world-wide scientific collaborations and, to some extent, need this data to be available on demand.

To address the challenge of big data storage and analysis tools, ten public research organisations from seven European countries joined forces in a Pre-Commercial Procurement (PCP). All the members of this buyers group were interested in the potential benefits of hybrid cloud solutions and, by buying together, hoped to achieve:

- economies of scale to reduce cost of cloud resources,
- more elasticity to adapt to changing demands for faster and more efficient scaling,
- more concentration on science-specific services/demands not covered by commercial cloud providers, and
- standardisation to make computational and storage infrastructure changeable and replaceable.

This innovation challenge was addressed by the Helix Nebula Science Cloud, a PCP action co-funded by the H2020 Framework Programme. The initiative brings together leading IT providers and some of Europe's biggest research centres – CERN, CNRS, DESY, EMBL, ESRF, IFAE, INFN, KIT, STFC and SurfSARA – charting a course towards sustainable cloud services for research communities.

PROCUREMENT OBJECTIVES

The objective of this procurement was to address the challenges outlined above, which required a combination of services under an innovative Infrastructure as a Service (IaaS) model:

- Compute and Storage – support a range of virtual machines and container configurations;
- Network Connectivity and Federated Identity Management – provide high-end network capacity for the whole platform with common identity and access management;
- Service Payment Models – explore a range of purchasing options to determine the most appropriate ones for the scientific application workloads that will be deployed.

The consortium, as first buyers of new research and development (R&D) with important technological needs, chose a PCP approach in order to drive innovation from the demand side. The cloud platform needed to be available to end-users around the world in an on-demand and elastic manner, meet the essential criteria of Reliability, Availability and Security (RAS), including providing cost-effective services exploiting capacity-style CPU cycles and online storage connected via high-speed networks to execute a range of scientific workloads from computing intensive simulations to data intensive analysis. The core of this innovative approach was in the connection with publicly funded e-Infrastructures based on open source solutions, to build a hybrid platform on top of which a range of higher-level user specific services can be deployed.

PROCUREMENT PROCESS

PRE-PROCUREMENT ACTIONS

The Science Cloud Strategic Plan was adopted by representatives of all stakeholder groups at a workshop hosted by ESA/ESRIN in summer 2011 and, thereafter, a public-private group of end-users of the cloud services and commercial service providers was formed and a common vision was consolidated. Preparation for this PCP began in January 2016, including the analysis of end-user needs, current market capabilities and relevant standards. Based on this, a set of procurement objectives was established to guide the process.

MARKET SOUNDING AND ENGAGEMENT

The prior information notice (PIN) was published in January 2016, and soon after an open market consultation was held by CERN, at which potential suppliers were invited to get to know the end-users' needs and ambitions. The buyers group also used the market consultation and a subsequent survey of market players to better understand market capabilities and, thus, ensure appropriate tender criteria and provider participation. Following the publication of the contract notice in July 2016, an information session was held by CERN in September 2016 to resolve any doubts about the tender. A website (http://www.helix-nebula.eu/) was set up containing all relevant information on the tender provided to potential suppliers, Q&As and proceedings of the market consultation.

PROCUREMENT PHASES

This procurement followed an open procedure and was co-funded by the European Union's H2020 Framework Programme under Grant Agreement 687614. The total contract was worth €5,383,332 and ran from January 2016 to December 2018, including preparation, implementation and dissemination.

R&D for the services contracted was split into phases, with the number of competing suppliers being reduced after each evaluation phase.

— Phase 1. Solution design of the Hybrid Cloud Platform: establishment of a written detailed design report including architecture and technical design of components. Budget: €466,291 From: November 2016 to January 2017.

— Phase 2. Prototype implementation of the Hybrid Cloud Platform: complete prototypes were built and made accessible to the buyers group. During the prototyping phase, basic functionality, interoperability and security tests were performed by IT specialists from the buyers group. Budget: €1,378,707 From: February 2017 to November 2017.

— Phase 3. Pilot deployment of the Hybrid Cloud Platform: deployment of expanded pilots and exploration of service payment models. Further testing on scalability and robustness was performed. Budget: €3,454,900 From: February 2018 through November 2018.

During the second half of 2018, the PCP project drew upon the previous phases and focused on sharing best practices, developing recommendations, and training.

SUBJECT MATTER OF THE CONTRACT:

Joint Pre-Commercial Procurement of Cloud Services

AWARD CRITERIA

The contract was awarded based on Most Economically Advantageous Tender (MEAT) criterion. Each phase of the PCP was competitive.

Award criteria in the tender included non-technical aspects (40):

- Merit of the resources (12),
- Merit of the technical capacity (12),
- Merit of the time schedule (8), and
- Commercialisation approach (8),

as well as technical aspects (100):

- Large data sets (10),
- Data access (10),
- Container support (10),

- Network peering (10),
- Support for identity and access management services (8),
- Business models (8),
- Service level agreements - SLAs (8),
- IaaS Innovative cloud service requirements (8),
- Cloud services (5),
- Data protection and security (8),
- Reporting, accounting and management portal (5),
- Support desk (5), and
- High-performance computing as a service - HPCaaS (5).

Apart from those non-technical and technical criteria, price was weighted as 60 points. The financial offer of each bid was scored on "Actual Price" according to the following formula: *Points awarded = (1 - (tender price / maximum price))* maximum of points on Price.* In total, the overall possible score for each bid was 200 points. Tenderers were to surpass a threshold of 50% (70/140) on quality criteria to proceed to the subsequent phase.

EVALUATION

At the end of each phase, the bids were tested by technical experts of the buyers group for quality, and evaluated against the tender criteria by the Evaluation Committee, which assessed each tender individually, independently and remotely. All tenders considered had eligible financial offers, but some were eliminated for not meeting the 70-point threshold on quality criteria. Only contractors that successfully completed the previous phase were allowed to bid in the subsequent phase.

A total of 28 multinational companies, SMEs and public research organisations from 12 countries submitted bids in the first round. From an initial set of ten bids, four were selected to produce designs in Phase 1, for which those four providers entered a Framework Agreement with the buyers group. At the end of Phase 1, three providers were selected to develop prototypes in Phase 2. Finally, in Phase 3 two providers were selected to fully develop and pilot a hybrid cloud service with the buyers group. A Total Cost of Ownership (TCO) study for selected use cases was introduced in the pilot phase to help the buyers group understand the impact of the contractors' commercialisation plans.

RESULTS

Two consortia (T-Systems and RHEA) were selected to deploy platforms offering each 10,000 CPU cores, 1 petabyte of storage and 40Gbps network connectivity. The group of procuring research organisations have successfully deployed applications and datasets used by end-users from astronomy, high energy physics, life sciences and photon/neutron sciences on these innovative cloud services.

The consortium of end-users are now actively using the Helix Nebula Science Cloud (HNSciCloud). This solution is a hybrid cloud platform that links together commercial cloud service providers and publicly funded research organisations' in-house IT resources to provide innovative solutions supporting data intensive science. Many reports documenting the process as well as guidelines and online platforms facilitate the sharing and wide replication of this PCP approach and its resulting innovative cloud service.

The PCP process, and specifically the consideration of the resulting total cost of ownership (TCO), has permitted the public research sector to make use of the latest, most energy-efficient IT technologies hosted in recent data centres with excellent power usage effectiveness, meaning the energy consumption required for intensive computing is minimised.

The HNSciCloud pilot phase also identified a gap in the current market offering for long-term data preservation services. The lessons learned and experience gathered in HNSciCloud are being applied in a new PCP action to fill this gap called ARCHIVER (https://www.archiver-project.eu).

As a further outcome of the initiative, innovative cloud services will be made accessible to a larger set of public research and higher education organisations in the context of the Open Clouds for Research Environments (https://www.ocre-project.eu/).

In recognition of its outstanding use of PCP for the HNSciCloud, CERN was also awarded the 2019 Procura+ Outstanding Innovation Procurement in ICT Award, which is supported by the EU-funded Procure2Innovate Project.

CERN winning the 2019 Procura+ Award for Outstanding Innovation in ICT Procurement. Photo credit: Jan Inge Haga

LESSONS LEARNED

Based on their experience with PCP for cloud services, the HNSciCloud consortium found the following to be valuable lessons:

- Invest effort in the tender preparation phase (between 9-12 months) to agree and precisely define the R&D challenges, the objectives and the expected outcome of the PCP.
- Prepare an in-depth needs assessment and an open market consultation activity during the tender preparation phase. Organise events where the procurers and potential tenderers can progressively refine the focus under the guidance of experts. Launch a survey among the known market players to allow the procurers to detect the capabilities and the willingness of the market to participate in the tender.
- In the tender process, nomination of a lead procurer who already had longstanding relationships with all members of the buyers group proved a successful approach. Close cooperation between the members of the consortium as well as with the contractors has been an important element of this initiative's success.
- Include provisions in the award criteria to ensure that proposed solutions by competing providers are sufficiently distinct and multiple solutions for each challenge are developed. Strive to contract a higher number of providers during each phase to ensure sufficient competition and increase the likelihood of a successful completion.
- Schedule intermediate reviews and payments as important checkpoints for the buyers group and contractors, to ensure all parties remain active and engaged.
- Establish mechanisms for the buyers group to prioritise the challenges, communicate these priorities to the contractors and take them into account when allocating resources during the execution phase.

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