

## Helix Nebula – The Science Cloud

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*Flagship use cases for the purposes of this document are European scientific computing infrastructure and services requirements. This document provides a template for assessment of potential flagship use cases to be considered for the Strategic Plan for a Scientific Cloud Computing infrastructure for Europe. This Cloud Infrastructure includes European R&D Cloud Computing Infrastructure that serves the need of European Research Area (ERA) and Space Agencies. Existing participants from the European research community include CERN, ESA and EMBL. This Cloud Infrastructure forms a public-private partnership between the research organisations and commercial cloud service providers with the potential to extend services to a broad range of customers including government and the wider commercial community at large in the future. The initial focus has been on IaaS which can be used to quickly support a small number of scientific flagship use cases with a view to adding PaaS and SaaS services based upon the IaaS framework at a later date. The initial flagship use cases were proposed by the demand-side were chosen for their scientific challenge with societal impact, ability to profit from existing services on the supply-side, community building aspects and innovation potential that helped form the private-public partnership. These aspects remain important for future flagship use case candidates also. The initial flagship use cases were selected so as to be complementary and maximise coverage of the objectives outlined in the Strategic Plan.*

*The requirements gathering template has been created based on the direct experience of deploying the initial flagship use case proof of concept environments on the various cloud platforms from the supply-side. The requirements gathering template is also based on the experiences from the suppliers with supplying IaaS in the Cloud market*

*The flagship use cases have been implemented as part of an initial pilot phase lasting no more than two years. As such, all flagships must be sponsored by organisations that have a long-term objective of outsourcing a portion of their computing requirements to a cloud based delivery platform. The purpose of this template is to ensure sufficient information is gathered about proposed future flagships and the required service levels of requesting, deploying, operating and terminating the IaaS services for the flagships as part of the planning and selection process.*

*The purpose of this template is to ensure sufficient information is gathered about proposed future flagships as part of the planning and selection process.*

*The three initial flagship use cases chosen were CERN High Energy Physics, Genomic Assembly in the Cloud with EMBL and the SuperSites Exchange Platform from ESA.*

*The [ATLAS experiment](#) is currently running a large scale distributed computing system to process the data acquired by the experiment. The ATLAS Distributed Computing environment (ADC)*

*consists of several pieces: a Distributed Data Management component (DDM), a distributed production and analysis system (PANDA), and associated tools as well as the processing and analysis binaries. This flagship is part of a wider project within ATLAS, to research the applicability of cloud computing to ATLAS computing.*

*The [European Molecular Biology Laboratory](#) (EMBL) is developing a portal for cloud-supported analysis of large and complex genomes. This will facilitate genomic assembly and annotation, allowing a deeper insight into evolution and biodiversity across a range of organisms.*

*[Geohazard Supersites](#) is an international partnership of projects, organizations and scientists, involved in monitoring the dynamic and complex solid-Earth system and the assessment of geohazards. Its mission is to support the [Group of Earth Observation](#) (GEO) in the effort to reduce loss of life and property caused by the natural disasters of earthquakes and volcano eruptions. The Geohazard Supersites project will advance scientific understanding of the physical processes which control earthquakes and volcanic eruptions as well as those driving tectonics and Earth surface dynamics.*

*The supply-side will work closely with future flagship use case proposers to determine what features and capabilities of cloud computing environments are needed to support the type of computing exemplified by the selected use cases.*

*Flagship proposers must be prepared to contribute their own resources during the pilot phase establishing working proof of concepts with the various supply-side participants in order to port the application to the cloud infrastructure and contribute to the cost of procuring the required services from the supply-side.*

*Future flagships would preferably be “photogenic” high-profile applications that can catch the public imagination and act as very visible use cases to encourage others to use the services. Important characteristics of the flagship projects include the need for a significant scale of resources, federation/aggregation of data sets, long-term archiving of data and on- demand processing by a global user community. The impact of flagships on the user community and how the cloud deployment will become an integral part of the research environment are of great importance.*

*Proposers must be prepared to share information about the flagship applications, their scientific objectives, technical requirements, service requirements and results so that the infrastructure and service levels can be established, improved and promoted to a wider audience. A business case study will be an important part of the pilot phase and the flagship proposing organisation*

*must be prepared to participate in a costing exercise where the total cost of requesting, deploying, operating and terminating the flagship application on in-house resources can be compared to the cost of procuring the services via the cloud computing initiative.*

*The process of assessing the potential flagship use cases to form a Strategic Plan for a Scientific Cloud Computing infrastructure for Europe takes an iterative approach. The participating research organisations and commercial cloud service providers will exchange information about the current situation, expectations and requirements/capabilities to determine the blueprint of the Science Cloud market. This blueprint covers aspects about the required and supported technology, service levels, terms of agreement, pricing structure, organization of the market and much more. All these aspects can't be settled in a single round of discussions. Therefore an iterative approach is taken that will refine and add relevant aspects of the blueprint.*

*For the requirements gathering this iterative approach is expressed in the focus of the assessment. Per iterative step the focus will refine and add aspects until a sufficient level of knowledge is obtained to complete the blueprint of the Science Cloud market. This document is the first step of the iterative process. It contains questions about expectations for the future, service levels and legal subjects but these will most likely be refined and expanded in the next steps.*

*The goal of the requirements gathering is to create insight for the participating suppliers. Although the participating research organizations can state the current situation and their expectations in this template, it doesn't mean that the resulting Science Cloud will support all of them. The participating suppliers will validate the information collected in this assessment against realistic delivery options (Task 4.2 of Work Package 4) and inform the participating research organizations about the results. Here the iterative approach shows its value. After an iterative step of requirements gathering and validation against realistic delivery options a next iterative step is executed. In this next iteration both requirements and delivery options can be adjusted to create alignment of the two.*

*Proposers are asked to complete the sections in this template.*

*Flagship title:*

*Acronym for the flagship:*

*Scientific Organisation(s) sponsoring the flagship:*

*Contact person (name, affiliation, email):*

*Scientific Objective:*

Summarise the scientific objectives for the flagship in laymen's terms.

*State-of-art in the use of computing in the scientific field:*

Position the flagship with respect to the currently most advanced use of computing in the field

*Expected Impact and Benefits:*

By implementing the flagship on a commercial cloud system what impact will the result have on the scientific field? What benefit will it bring to the scientific community that the proposer organisation(s)

directly address? Provide details about the scientific community that will benefit from this flagship and expected impact on scientific results. Include an estimate the number and distribution of users that will need access to the system.

*Existing or potential partnership:*

Which partner(s) outside the user organisation, and in particular SME, would be participating in the Flagship?

*Current status of maturity:*

*Proposer Resources:*

Indicate the level of resources (manpower and funds) your organisation is willing to contribute towards the cost of implementing your flagship during the 2 year pilot phase.

*Proposer Motivation:*

Explain which aspects (such as secure access, financial models, scalability of resources, portability between service suppliers, use of standardized interfaces etc.) you consider to be the most important to investigate in the porting and deployment of your flagship during the pilot phase. Outline what expected benefits for the proposer organisation(s) are hoped to be achieved by participation.

*Proposer Long-term Objectives:*

Assuming your flagship is successfully ported and deployed during the pilot phase, what would be the long-term objectives of your organisation for the use of the cloud infrastructure?



## 1. Flagship Requirement Framework

This requirements gathering template has been prototyped with the experiences of the three initial flagships and refined based on feedback and experience gained as reported at the general assembly in July 2012

### 1.1 Technological (non-functional)

#### 1.1.1 Connectivity Options

Please define the connectivity method expected to be utilised. Please select all methods that are compatible with a successful deployment.

Method	Check as appropriate
Internet	<input type="checkbox"/>
MPLS	<input type="checkbox"/>
VPN	<input type="checkbox"/>
Secure Remote User Access	<input type="checkbox"/>
Direct private patch to local switch	<input type="checkbox"/>

#### 1.1.2 Initial Infrastructure Characteristics

Please outline in as much detail as possible the initial near-term infrastructure requirements for the flag ship proof of concept deployment. Please base this figures as closely as possible to existing infrastructure deployments and known working set-ups.

Area	Requirements
Peak requirements in terms of CPU, RAM, disk storage (GHz, GB, GB)	
Data requirements (quantity of data - GBs, files/databases accessed/produced including size & type)	
Single/multiple binaries (indicate dependencies between multiple binaries, connectivity requirements, etc.)	
Peak server size required per resource (server size required in terms of the largest CPU configuration, largest RAM configuration, etc.)	

Programming model (serial, parallel, shared memory, threads, data parallel, etc.)	
Style of interaction with the user (interactive/batch)	
External connections (e.g. data input/output rates and access to external databases in Mbps)	
Expected external connectivity volume (GB/TB per which time frame)	
Peak expected bandwidth to/from a cloud server (Mbps/Gbps)	
Security requirements (e.g. confidentiality of data, algorithms)	
Licensing aspects (e.g. does the software make use of third party packages requiring licenses)	
Operating environment (operating system and version, libraries etc.)	
Other technical requirements	

### 1.1.3 Future Infrastructure Characteristics

Please outline in as much detail as possible the eventual infrastructure requirements and potential of the flagship.

Area	Requirements
Peak requirements in terms of CPU, RAM, disk storage (GHz, GB, GB)	
Data requirements (quantity of data-GBs, files/databases accessed/produced including size & type)	
Single/multiple binaries (indicate dependencies between multiple binaries, connectivity requirements, etc.)	
Peak server size required per resource (server size required in terms of the largest CPU configuration, largest RAM configuration, etc.)	
Programming model (serial, parallel, shared	

memory, threads, data parallel etc.)	
Style of interaction with the user (interactive/batch)	
External connections description and speed in Mbps(e.g. data input/output rates and access to external databases)	
Expected external connectivity volume (GB/TB per which time frame)	
Peak expected bandwidth to/from a cloud server (Mbps/Gbps)	
Security requirements (e.g. confidentiality of data, algorithms)	
Licensing aspects (e.g. does the software make use of third party packages requiring licenses)	
Operating environment (operating system and version, libraries etc.)	
Other technical requirements	

### 1.1.4 Images

#### 1.1.4.1 Format

Please check the formats of legacy server and/or drive images that will be provided for the proof of concept environment. If images can be provided in multiple formats, please select all applicable formats.

Type	Check as appropriate
QCOW	<input type="checkbox"/>
QCOW2	<input type="checkbox"/>
QCOW3	<input type="checkbox"/>
VPC	<input type="checkbox"/>
DMG	<input type="checkbox"/>
BOCHS	<input type="checkbox"/>
VMDK	<input type="checkbox"/>
RAW	<input type="checkbox"/>
Other (please specify)	

#### 1.1.4.2 Store

Please select whether server images being provided are private or publicly available images. Some flagships wish to have their images available to the wider community on their deployment clouds, if so please select public, if not please select private.

Type	Check as appropriate
Public	<input type="checkbox"/>
Private	<input type="checkbox"/>

#### 1.1.4.3 Types

Please select the correct server image type based on the technology you use today. Again, please select all applicable technologies used.

Type	Check as appropriate
VirtualBox	<input type="checkbox"/>
KVM	<input type="checkbox"/>
XEN	<input type="checkbox"/>
VMware	<input type="checkbox"/>
ESX	<input type="checkbox"/>
Hyper-V	<input type="checkbox"/>
Others (please specify)	

#### 1.1.4.4 Access methods (upload, download)

Please select the access methods for importing and extracting server images for the flagship to the Helix Nebula cloud framework that you would wish to be made available.

Method	Check as appropriate
FTP (including SFTP)	<input type="checkbox"/>
API via Https	<input type="checkbox"/>
P2P	<input type="checkbox"/>
PV2	<input type="checkbox"/>
V2V	<input type="checkbox"/>
Via Custom Virtualization Service	<input type="checkbox"/>

### 1.1.5 Resource Sizing

Please outline different server node types required for the proposed flagship proof of concept deployment. Be especially sure to include server configuration types that represent the minimum and maximum requirements even if their aggregate number is small. Additionally, providing a % guide of the overall importance of each server type is also useful. Fill in as many tables as you deem appropriate with regards to covering the majority of your expected flagship deployment.

#### 1.1.5.1 Example Server Type A

Resource	Quantity	Metrics
CPU/Core		GHz/core
RAM		GB/per VM
HDD		GB/per VM
SSD		GB/per VM
NETWORK		Gbps/per VM

#### 1.1.5.2 Minimum Server Type B

Resource	Quantity	Metrics
CPU/Core		GHz/core
RAM		GB/per VM
HDD		GB/per VM
SSD		GB/per VM
NETWORK		Gbps/per VM

#### 1.1.5.3 Minimum Server Type C

Resource	Quantity	Metrics
CPU/Core		GHz/core
RAM		GB/per VM
HDD		GB/per VM
SSD		GB/per VM
NETWORK		Gbps/per VM

#### 1.1.5.4 Minimum Server Type D

Resource	Quantity	Metrics
CPU/Core		GHz/core
RAM		GB/per VM
HDD		GB/per VM
SSD		GB/per VM
NETWORK		Gbps/per VM

#### 1.1.5.5 Minimum Server Type E

Resource	Quantity	Metrics
CPU/Core		GHz/core
RAM		GB/per VM
HDD		GB/per VM
SSD		GB/per VM
NETWORK		Gbps/per VM

#### 1.1.5.6 Minimum Server Type F

Resource	Quantity	Metrics
CPU/Core		GHz/core
RAM		GB/per VM
HDD		GB/per VM
SSD		GB/per VM
NETWORK		Gbps/per VM

#### 1.1.5.7 Minimum Server Type G

Resource	Quantity	Metrics
CPU/Core		GHz/core
RAM		GB/per VM
HDD		GB/per VM
SSD		GB/per VM
NETWORK		Gbps/per VM

### 1.1.6 Virtualization

If you currently use virtualisation technologies and may rely on specific hypervisors please outline your usage currently. Select all applicable options for the flagship legacy deployments.

HyperVisor	Semi	Full
KVM	<input type="checkbox"/>	<input type="checkbox"/>
XEN	<input type="checkbox"/>	<input type="checkbox"/>
VMware	<input type="checkbox"/>	<input type="checkbox"/>
Hyper-V	<input type="checkbox"/>	<input type="checkbox"/>
ESX	<input type="checkbox"/>	<input type="checkbox"/>
Other (please specify)		

## 1.2 Relevant Software Systems

Please outline any relevant software systems in use for the flagship today and what systems might be required going forward as part of the initial flagship proof of concept. For example, if you currently rely on Starcluster, Sun GridEngine or similar please outline this here.

Experience has shown that relevant software systems introduce the highest degree of risk and complexity to new flagship deployments. Please do provide in as much detail as possible systems currently used and required for the flagship including if they reference outside standards or services (for example Starcluster uses Amazon's EC2 API for provisioning).

Note: Please note this section is for requirements gathering purposes only, certain software systems may not be possible or appropriate to deploy within a cloud environment.

### 1.2.1 Portability of applications

Please outline the current situation, possible restrictions and any requirements on the portability of applications used by the flagship.

### 1.2.2 Test and Go live strategy

Please outline the current practices, considerations and requirements on the test and go live strategy used by the flagship.

## 1.3 Operational

### 1.3.1 Request for Cloud service

The questions below are to determine the ranges that are expected to be supported in a request for a Cloud service as part of the flagship.

Question	Response
Minimum number of servers in a request	
Most likely number of servers in a request	
Maximum number of servers in a request	
Minimum amount of storage in a request	
Most likely amount of storage in a request	
Maximum amount of storage in a request	
Minimum amount of additional external bandwidth in a request	
Most likely amount of additional external bandwidth in a request	
Maximum amount of additional external network bandwidth in a request	
Preferred lead time to provide requested Cloud service	
Maximum allowed lead time to provide requested Cloud service	
Minimum duration of initial service provision to be supported	
Preferred duration of initial service provision	



Question	Response
Maximum duration of initial service provision you are willing to commit to	
Minimum duration of extension of service provision to be supported	
Preferred duration of extension of service provision	
Maximum duration of extension of service provision you are willing to commit to	
Minimum notification period for extension of service provision to be supported	
Preferred notification period for extension of service provision	
Maximum allowed notification period for extension of service provision	
Should service provision for indefinite duration be supported	
Shortest time period for service provision of indefinite duration to be supported	
Preferred time period for service provision of indefinite duration	
Maximum time period for service provision of indefinite duration you are willing to commit to	
Minimum notification period for termination of service provision to be supported	
Preferred notification period for termination of service provision	
Maximum allowed notification period for termination service provision	

### 1.3.2 User Management

Please outline any requirements for user management.

Question	Response
Specify the types of users (e.g. users using existing services, users authorized to order new services, system administrators, etc.)	
Which party should own the information about the users	
Which party should maintain the information about the user	
How should information about the users be exchanged (e.g. API, Web Console, Custom software)	

Other requirements for user management.

### 1.3.3 Service catalogue access

Please outline any requirements for Service catalogue access.

Question	Response
How should the service catalogues from the multiple suppliers be presented to the users (e.g. each supplier presents its own service catalogue, there is a single integrated service catalogue that presents the services of all suppliers, the research institute selects which service catalogue information they want to present to their users, etc.)	

Question	Response
How do you want to access to the service catalogues (e.g. API, Web Console, Custom software)	

Other requirements for Service catalogue access.

### 1.3.4 Provisioning

Please outline in the sub-sections below the resource provisioning models desired or required as part of the flagship deployment. Key areas to include are if automatic provisioning via API is required, aspects of any API functionality that may be required, expecting scaling requirements and models, required resource lead times, etc.

#### 1.3.4.1 Resource Usage Profile

Please outline the resource usage profile for deploying resources. Please indicate the variance of resource requirements over time, the length resources are expected to run for and the preferred method of usage.

For example, will work loads be brought up in an ad hoc manner depending on requirements are do they represent long term relatively stable needs?

#### 1.3.4.2 Resource Lead Times

Please outline acceptable lead times for new long term capacity requirements as well as short term ad hoc variable requirements as appropriate.

#### 1.3.4.3 Scaling

If you are expecting variable resource needs over time please outline how this scaling is envisaged. For example, is a horizontal or vertical scaling model expected to be utilised?

#### 1.3.4.4 Provisioning System Service Level

Please outline any requirements regarding availability and quality of service aspects of any provisioning tools you intend to use (such as API, web console etc.)

#### 1.3.4.5 Content delivery

Please outline any requirements regarding the delivery of content during the provisioning like the method of adding the content to the provided resource and any content delivery tools you intend to use (such as API, web console etc.)

#### 1.3.4.6 Software deployment

Please outline any requirements regarding the deployment of software during the provisioning like the method of adding / including the software to the image and any software deployment tools you intend to use (such as API, web console etc.)

### 1.3.5 External Management / Compatibility

If you currently already utilise any cloud management tools please select them here. Please note separately in this section any preferences for cloud management tools that would be desirable in the future.

Provider/Standard	Compatibility
Jclouds	<input type="checkbox"/>
EGI OCCl	<input type="checkbox"/>
Libcloud	<input type="checkbox"/>
OpenNebula	<input type="checkbox"/>
EC2	<input type="checkbox"/>
Others (please specify)	

### 1.3.6 Monitoring

Please outline any tools and requirements for monitoring of your system. If you have specific tools used already please outline them. Please also specify the aspects of computing being monitored, metrics, etc.

Component	Tool	Note
System Monitoring		
Performance Monitoring		
Network Monitoring		
Website Monitoring		
Security Monitoring		

No vendor or tool lock-in shall be imputed.

### 1.3.7 Service level reporting

Please outline any requirements for service level reporting of the services.

Question	Response
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Question	Response
How should the service levels from the multiple suppliers be presented to the users (e.g. each supplier presents its own service levels for the delivered services, there is a single integrated service level reporting system that presents the services levels of all suppliers for the delivered services, the research institute assembles the service level reports they want to present to their users from information from the suppliers, etc.)	
Who should have access to the service level reports (e.g. all users of the service, the owner of the service, specific persons / roles within the institute, etc.)	
How do you want to access to the service level reports (e.g. API, Web Console, Custom software)	

Other requirements for service level reporting.

### 1.3.8 Contract management

Please outline any requirements for contract management of the services.

Question	Response
How should the contract information of the services from the multiple suppliers be presented (e.g. each supplier presents its own contract information for the delivered services, there is a single integrated contract information system that presents the contract information of all suppliers for the delivered services, the research institute assembles the contract information they want to present from information from the suppliers, etc.)	
Who should have access to the contract information of the service (e.g. all users of the service, the owner of the service, specific persons / roles within the institute, etc.)	
How do you want to access to the contract information (e.g. API, Web Console, Custom software)	

Other requirements for contract management.

### 1.3.9 Asset / software license management

Please outline any requirements for asset / software licence management. This concerns assets / software running on the servers of the Science Cloud but that is not part of the Science Cloud service. The institute is responsible for acquiring the software licenses and probably wants insight on the assets / software running on the servers of the Science Cloud.

Question	Response
Specify the tooling (mention supplier, software name and version) used to collect assets / software used by the flagships (e.g. manually so no tooling, discovery tooling, software distribution tooling, software license management tooling)	
Specify the tooling (mention supplier, software name and version) used to administrate assets / software used by the flagships (e.g. manually so no tooling, CMDB, software license management tooling)	
Who should collect assets / software used by the flagships running on, but not part of the cloud services (e.g. the owner of the service, a specific person / role within the institute, the supplier of the cloud service)	
How do you want to access to the asset / software license information (e.g. API, Web Console, Custom software)	

Other requirements for asset / software license management.



### 1.3.10 Preferred Cloud-Interface

Please outline any expected infrastructure management models for the various management aspects outlined below.

#### 1.3.10.1 Provisioning

Method	Note
API	
Web Console	
Custom Software	

#### 1.3.10.2 Security

Method	Note
API	
Web Console	
Custom Software	

#### 1.3.10.3 Networking

Method	Note
API	
Web Console	
Custom Software	

#### 1.3.10.4 Billing

Method	Note
API	
Web Console	
Custom Software	

### 1.3.11 OS Required

Please outline the operating systems you intend to utilise as part of the flagship deployment including specific versions. Select multiple options based on your deployment needs.

OS	Version	Check as appropriate
AIX		<input type="checkbox"/>
AmigaOS		<input type="checkbox"/>
BSD		<input type="checkbox"/>
Caldera Linux		<input type="checkbox"/>
Centos		<input type="checkbox"/>
Corel Linux		<input type="checkbox"/>
Crux		<input type="checkbox"/>
Debian Linux		<input type="checkbox"/>
DUnix		<input type="checkbox"/>
DYNIX/ptx		<input type="checkbox"/>
Fedora		<input type="checkbox"/>
Gentoo		<input type="checkbox"/>
Haiku OS		<input type="checkbox"/>
HP-UX		<input type="checkbox"/>
IRIX		<input type="checkbox"/>
Kondara Linux		<input type="checkbox"/>
Knopix		<input type="checkbox"/>
MAC OS		<input type="checkbox"/>
Mandrake		<input type="checkbox"/>
Mandriva		<input type="checkbox"/>
Minix		<input type="checkbox"/>
Ms-DOS		<input type="checkbox"/>
QSF		<input type="checkbox"/>
QNX		<input type="checkbox"/>
Oracle Linux		<input type="checkbox"/>

RHEL		<input type="checkbox"/>
SCO		<input type="checkbox"/>
Scientific Linux		<input type="checkbox"/>
Slackware Linux		<input type="checkbox"/>
Sun Solaris		<input type="checkbox"/>
SUSE Linux		<input type="checkbox"/>
System		<input type="checkbox"/>
True64		<input type="checkbox"/>
TurboLinux		<input type="checkbox"/>
Ubuntu		<input type="checkbox"/>
Ultrix		<input type="checkbox"/>
Unisys		<input type="checkbox"/>
Unix		<input type="checkbox"/>
Windows		<input type="checkbox"/>
Xandros		<input type="checkbox"/>
Xenix		<input type="checkbox"/>
		<input type="checkbox"/>
		<input type="checkbox"/>

*\*Empty cells are to be populated in case of a required OS that is not included in the list*

### 1.3.12 Software Licensing

Please outline your requirements with regards to software licensing. If you are expecting to host licensed commercial software as part of your flagship deployment please fill in this section. For example, if utilising Windows servers do you have a preferred methodology for licensing such as using your own existing licenses or using the cloud vendor SPLA licenses.

### 1.3.13 Provider Server Access

Do you anticipate cloud infrastructure providers to have access to running cloud virtual machines? If so please specify acceptable access levels (read-only, instantiation-only etc.) and visibility of data. For

example to provide certain managed services access to virtual machines may be required by the cloud infrastructure provider.

### 1.3.14 User Server Access

Please outline the remote access methods you intend to utilise to manage flagship cloud infrastructure.

Method	Note
VNC	
SSH	
RDP	
NX	

### 1.3.15 Cloud Infrastructure Quality of Service (QOS)

In this section please outline in as much detail as possible quality of service requirements in relation to cloud infrastructure.

#### 1.3.15.1 Availability

Please outline uptime requirements in relation to availability of cloud infrastructure. Consider your relevant measure of uptime and define it here. Define any requirements in relation to metrics such as Mean Time Between Failures (MTBF), Mean Time To Repair (MTTR), Recovery Time Objective (RTO) and Recovery Point Objective (RPO), and similar here also.

#### 1.3.15.2 Performance

If any minimum performance guarantees and service level agreements may be required please outline them in as much detail as possible here. For example, a flagship deployment may require a service level agreement around maximum network latency between cloud servers or a minimum network

throughput. Such aspects to be backed by service level agreements need to be outlined here. These requirements are distinct from general requirements that don't necessitate specific SLA specification.

#### 1.3.15.3 Reliability/Durability

Please outline any aspects relating to reliability here. If you have requirements for data resilience/durability, recovery and/or retention, data integrity; this is the correct section to outline such requirements. Please use clear metrics wherever possible, for example in the case of durability state the acceptable % loss rate over a defined time period if such a requirement exists.

#### 1.3.15.4 Accessibility

Please outline any aspects relating to accessibility here. Accessibility differs from availability in the sense that accessibility reflects functionality (systems) needed to be able to access the Cloud service but is not managed by the supplier. Examples are the networks connecting the institute with the supplier and Identity management systems located at the institute that the supplier of the Cloud service needs to verify if a user is authorized for the service. Please use clear metrics wherever possible. For example outline uptime requirements in relation to metrics such as Mean Time Between Failures (MTBF) and Recovery Time Objective (RTO).

#### 1.3.15.5 Disaster recovery

Please outline any aspects relating to disaster recovery here. Disaster recovery differs from availability in the sense that disasters affect entire sites and therefore affect multiple customers and maybe even other suppliers. In general it is more complex to restore functionality after a disaster than after a service failure. Please use clear metrics wherever possible. For example outline requirements in relation to metrics such as Mean Time Between Failures (MTBF), Recovery Time Objective (RTO) and Recovery Point Objective (RPO).

### 1.3.16 Technical Support Models

Please outline any support models you require for the flagship deployment. Please indicate whether any support method is required or simply desirable.

Method	24/7	Note
Helpdesk	<input type="checkbox"/>	
Online Chat	<input type="checkbox"/>	
Forums	<input type="checkbox"/>	
Email	<input type="checkbox"/>	
FAQ	<input type="checkbox"/>	
Client Exposed Ticketing system	<input type="checkbox"/>	

### 1.3.17 Integration with local IT

Please outline any requirements and considerations to integrate the local IT support organization with the suppliers support organization for the flagship deployment. Please indicate whether any integration of support is required or simply desirable.

### 1.3.18 Enterprise Application Operation

Please outline any relevant aspects regarding enterprise application operations that are required for successful deployment. Please be as specific as possible.

### 1.3.19 Data and resource management

Please outline any requirements and considerations for data and resource management for the flagship deployment you were not able to specify in any other section of this document. Please indicate whether any aspect of data and resource management is required or simply desirable.

## 1.4 Security

Please use this section to define any security requirements not mentioned elsewhere in the document; using the following subheadings as a guide (not all headings are required).

### 1.4.1 Authentication, Authorisation and Accountability (AAA)

Method	Description
Identity enrollment requirements – how identity is initially verified.	
Single sign-on requirements for management interface	
RBAC management requirements – e.g. for remote management interface.	
Accountability requirements – security-related logging, signed timestamping, WORM functionality.	

#### 1.4.2 Remote management interface authentication requirements

Method/Standard	VM - Check if appropriate	Management interface – Check if appropriate
Username/password	<input type="checkbox"/>	<input type="checkbox"/>
Soft certificate (x.509)	<input type="checkbox"/>	<input type="checkbox"/>
Hardware PKI Tokens	<input type="checkbox"/>	<input type="checkbox"/>
Biometric	<input type="checkbox"/>	<input type="checkbox"/>
OTP	<input type="checkbox"/>	<input type="checkbox"/>
Multi-factor	<input type="checkbox"/>	<input type="checkbox"/>
Contextual re-authentication	<input type="checkbox"/>	<input type="checkbox"/>
Other		

#### 1.4.3 Network security requirements

Method	Description
LAN security (for internal transfers) – e.g. IPSec	
Network segregation	
Network access control (client health check)	

#### 1.4.4 Data lifecycle

Method	Description
Secure de-provisioning/ deletion requirements	
Hardware decommissioning requirements (degauss etc...)	
Specific data export/portability	



requirements (formats, time limits)	
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#### 1.4.5 Cryptography

Method	Description
Minimum SSH key length policy for remote access	
Key management	
At-rest encryption (e.g. encryption gateway)	
Crypto hardware/acceleration	
Entropy/randomness sources.	

#### 1.4.6 Incident and vulnerability management

Method	Description
Incident response services and service levels	
Incident/vulnerability severity classification used, if any	
Incident reporting (to/by demand side)	
Vulnerability reporting and management (to/by demand side)	
Testing requirements (e.g. external pen-testing)	
Third party security services used, interfaces required.	

#### 1.4.7 Legal/Policy/Compliance

Method	Description
Certifications required	
Right to audit	
Sector-specific laws applicable (e.g. for healthcare data).	
Any other procedural security policy requirements that would have to be complied with (e.g. around personnel clearance, subcontracting, jurisdiction).	

#### 1.4.8 Processing of personal data

Method	Description
Location/jurisdiction-limitations	
Third parties/subcontractor	
Breach notification	
Maximum, minimum data retention	
Access and rectification.	
Purpose limitation	

### 1.5 Networking

Please outline in more detail the expected networking requirements for the flagship. Include internal and external connectivity, availability requirements, private and public networking needs and an overall expected deployment topology.

Key Aspects	Description	Note
Estimate Necessary Capacity		

(peak bandwidth, 95 <sup>th</sup> percentile bandwidth)		
Topology		
Number of Nodes		
Multiple Interfaces		
Fail Over Plan		

### 1.5.1 Private Networking

If you require private networking, please outline any specific networking requirements in this section including the fixed options outlined below.

Feature	Check if Required	Metrics
Jumbo Frame	<input type="checkbox"/>	MTU
Q-in-Q	<input type="checkbox"/>	Double VLAN tag
Host Level Firewall	<input type="checkbox"/>	Boolean
DNS Based Load Balancing	<input type="checkbox"/>	Boolean

### 1.5.2 Public Networking

If you require public networking, please outline any specific networking requirements in this section including the fixed options outlined below.

Feature	Check if Required	Metrics
Jumbo Frame	<input type="checkbox"/>	MTU
Multiple IP addresses per Interface	<input type="checkbox"/>	Boolean
Host Level Firewall	<input type="checkbox"/>	Boolean
Reverse DNS Management	<input type="checkbox"/>	Boolean
ISP complaint	<input type="checkbox"/>	Boolean
IPv6 Support	<input type="checkbox"/>	Boolean

### 1.5.3 DNS

Please outline any DNS requirements for the flagship. These requirements include hostname addressability, custom hostname resolution, reverse DNS requirements, etc.

## 1.6 Storage

Please outline overall storage requirements for the flagship with respect to total capacity, availability and performance metrics.

Feature	Metrics
Capacity	
Availability	
Performance	
Usage Profile (frequency and ratio read/writes)	

### 1.6.1 Interfaces

#### 1.6.1.1 Block Device Storage

Block device storage exposes storage to virtual servers as mountable virtual drives. Please specify any block storage device requirements including maximum drive size, any need for multiple drives per server, etc.

#### 1.6.1.2 Volume Storage

Volume storage exposes storage as a network mount to virtual servers. Please specify any volume storage requirements including expected size, if multiple volumes are required, etc.

#### 1.6.1.3 Object Storage

In addition to the compute storage outlined above, if you have a requirement for [object storage](#) or inclusion of such storage would be desirable to the flagship please outline here.

### 1.6.2 Geographical data storage considerations

#### 1.6.2.1 Geographical data storage requirements

Geographical data storage requirements may arise from durability requirements, prevention of unwanted data transfer, etc. Please specify any geographical data storage requirements including expected size, methods to identify data clusters, location / distance requirements, etc.

#### 1.6.2.2 Large Volume Data Transfer

Large Volume Data Transfer can be triggered by changing suppliers but also by deploying processing resources in another site than where the data is located that will be processed. Please specify any requirements on large volume data transfer including expected size, transfer speed, mechanisms to prevent unwanted transfer, etc.

## 1.7 Billing

Please outline any preferred or required billing and purchasing models, for example 'burst' based resource billing versus 'subscription' based longer term billing.

If you have organisational requirements regarding reporting, invoicing, account use-age limits, agreed supplier lists, etc., please outline these in detail.

## 1.8 Legal Documents

### 1.8.1 SLAs

The service level agreement covers the qualitative aspects of your cloud deployments including such aspects as uptime, availability, performance metrics, compensation levels and more. Please use this section to outline any SLA requirements not already articulated in other sections of this agreement already.

### 1.8.2 Terms of Use

The terms of use document usually forms the primary legal document between the cloud provider and cloud user/customer. Please specify any particular requirements or preferences with regards to this document here.

### 1.8.3 Privacy Policy

The privacy policy covers all aspects of data treatment with regards to privacy that the cloud provider handles. This includes cloud customer records as well as actual data being stored within their clouds. Outline here any specific needs with regards to privacy policy here.

### 1.8.4 Acceptable Use Policy

Most cloud vendors have an acceptable use policy to protect the integrity of the cloud and its customers. If you have any aspects of usage or requirements that may be appropriate against such a policy please outline them here.

### 1.8.5 Intellectual Property Management

Transparency over ownership and treatment of intellectual property is an important aspect to consider when moving intellectual property to a third party. Any requirements regarding the treatment of your intellectual property please outline it here.

### 1.8.6 Vendor Neutrality

Vendor Neutrality is an important aspect to consider when moving services to a third party. Any requirements regarding vendor neutrality please outline it here.