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Deliverable D11.1 (DS7.1.1,1): Review of Y1 Tasks 1, 2, 3 and 4 Cloud Activities and Achievements



Deliverable D11.1 (DS7.1.1,1)

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Abstract

In GN3plus SA7, GÉANT is actively pursuing the delivery of cloud and mobile services to the European research and education community to enable NRENs to bring a range of attractive online services to their users with the right conditions of use and to enable users to benefit from the power and flexibility of mobile and cloud services. This report is an update of Year 1 progress for Task 1-4, which involves both organisational as well as technical aspects of cloud services.

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Executive Summary

In GN3plus Service Activity 7 (SA7), GÉANT is actively pursuing the delivery of cloud and mobile services to the European research and education community, to enable NRENs to bring a range of attractive online services to their users, with the right conditions of use, and to let users benefit from the power and flexibility of mobile and cloud services. SA7 aims to ensure that the NRENs aggregate demand and collaborate on clouds to optimally position the NRENs to play an active role with respect to the rapidly developing cloud paradigm, so that the benefits of the cloud can be fully realised and the attendant risks appropriately managed.

This work involves both organisational as well as technical aspects, including:

- Cloud strategy and organisational change, to adapt to the cloud model and increasing use of mobile services.
- Cloud standards, to achieve interoperability.
- Demand aggregation and vendor engagement – setting a baseline of joint requirements, policies, legal and regulatory elements, to bring a safe and secure use and interoperability, facilitate procurement and distribution.
- Cloud integration, to connect cloud services to the IT infrastructure of the NREN community (the networks and AAI middleware), to provide users with easy access to a range of services, via their trusted institutional accounts.

Through this joint approach, NRENs are ‘moving up the stack’ and are bringing value to the GÉANT community. Linking the mobile and cloud services to the strong assets already in place (the network and middleware capabilities) offers GÉANT a unique position and the education and research community a well-integrated user experience.

The synergy between the following aspects will propel education and research in Europe:

- An advanced network with fixed connections and mobile capabilities.
- A strong AAI middleware integration infrastructure, with federated IdM and monitoring capabilities.
- Attractive cloud service offerings.

As will be shown in this document, the work undertaken in Task 1–4 of this Activity will support NREN’s development of these ‘cloud synergies’. An update on the progress of Task 5, dealing with mobile services, has not been included in this document, but is provided as a separate report (*Review of Y1 Task 5, Mobile Data Services*).

There is much to report for Task 1–4 at the end of Year 1. SA7 helps NRENs and others to gain a better understanding of cloud computing capabilities, supports NRENs' cloud activities and facilitates NRENs' choice and delivery of cloud services. SA7 aims to ensure that cloud services are easy to use, interoperable and provide a safe and secure work and learning environment.

There has been significant progress towards SA7's goals, with 14 NRENs participating in the collaboration. The information exchange and inter-working are vital, considering the cross-border collaboration needs of the Research and Education community and characteristics of cloud services. A cloud questionnaire was carried out and received responses from 23 NRENs, detailing capabilities and future needs. It also revealed two, distinct NREN paradigms: to broker cloud services and to be a cloud provider.

The resulting impact of this survey made it clear that a cloud solution will need to work for both views. A multi-service approach: broker cloud services from commercial providers, produce community cloud services and deliver these in a transparent way; thus providing clarity and choice to users.

The SA7 team used the feedback to define relevant service types for Year 1 and aims to increase the spread between commercial and community service offerings in future. The team also defined a draft version of a cloud distribution model, describing how NRENs can deliver cloud services to their communities.

Interoperability and standardisation are also important considerations for this Activity, which has developed a cloud standards and interoperability document that will be useful for future strategy, brokerage and integration work. Good contacts with DG Connect were also established, which included participation with the EC Cloud Working Group.

In terms of working towards a comprehensive portfolio of cloud services, the SA7 team has identified services that are most relevant for the research and education community, including Software as a Service (SaaS) and Infrastructure as a Service (IaaS). A document describing essential pre-conditions for potential cloud service providers was also drafted, which provides a Europe-wide baseline for the requirements that cloud providers are expected to meet. The team engaged with a range of cloud providers: both commercial vendors and providers from within the GÉANT community, all of them demonstrated their willingness to work with GÉANT and the NRENs. Some of the providers find it difficult to transcend their national sales approach.

In order to effectively present cloud services to the community, the team is preparing the development of an online cloud catalogue, a website (online directory) where services are presented the community.

Alongside work carried out during Year 1, a number of challenges have also been identified for Year 2, including the fostering of new cloud expertise, improving NREN positioning in order to better drive decision making for IT services, enabling the provision of a relevant cloud portfolio, and ensuring proper security measures are put in place throughout the collaboration.

1 Introduction

This section provides a roadmap to the content included in this document.

Section 2 outlines the overall goal of SA7, the potential benefits to the NRENs of this Activity and the planning in place to achieve this.

Section 3, provides an overall update on achieved progress in Year 1 to date.

Section 4 outlines Task 1's Cloud Strategy, which centres around networking and interconnecting the cloud capabilities of the community and commercial providers, building on the role of the NRENs.

Section 5 presents Task 2's Cloud Standards and Interoperability, which aims to promote the use of available interoperability standards (in the community and by service providers) and the development of standards that will greatly facilitate such integration.

Section 6 details Cloud Brokerage and Vendor Management, from Task 3, which includes the acquisition and management of the delivery of services from providers to the pan-European GÉANT community.

Section 7 covers the Cloud Integration work undertaken as part of Task 4, which provides technical expertise for integrating cloud services with the GÉANT and NREN networks and eduGAIN, AAI middleware.

Section 8 presents an overview of the communication efforts of the Activity to date.

Section 9 sets the scene for what lies ahead for SA7 in Year 2 of GN3plus.

Annex A provides background information about cloud services, their characteristics and why GÉANT is working on clouds in GN3plus

References and a **glossary** are also provided at the end of this report.

2 Goal and Planning

The overall goal of SA7 is to ensure that the NRENs aggregate demand and collaborate on clouds to optimally position the NRENs to play an active role with respect to the rapidly developing cloud paradigm, so that the benefits of the cloud can be fully realised and the attendant risks appropriately managed.

The GN3plus Service Activity Support to Clouds (SA7) enables NRENs to deliver cloud and mobile services to their communities, with the right conditions of use.

2.1 Delivery of Cloud Services

GN3plus SA7 is the delivery gateway that connects the clouds to research and education in Europe. It has a number of overall objectives to accomplish by the end of GN3plus in 2015, as shown below.

- Raise awareness about the opportunities and threats of cloud services and the need for NRENs to collaborate on clouds.
- Align NRENs (and promote their willingness to collaborate), and create a 'cloud foundation':
 - Information sharing; learn and evolve together; establish a common cloud language.
 - Overview of available cloud capabilities and components for NRENs and identify any gaps that need to be filled.
 - Comparable organisational transformation of NRENs, to adapt to the cloud distribution model and end-user centric approach of cloud services (users are choosers).
 - Encourage standardisation by defining joint requirements, policies and specifications on technical and legal aspects, to achieve interoperability and data portability (open) and security and privacy (closed).
- Aggregate demand and engage cloud providers collectively:
 - To establish frameworks for cloud services at a GÉANT community level (implementing the joint requirements and policies at vendors).
 - Ensure it is useful for NRENs to acquire cloud services at a national level.
- Integrate the cloud services with each other and the NREN network and middleware AAI assets, through close collaboration with vendors and the GN3plus Activities working on networks and middleware.

- Make these brokered and integrated services available in a GÉANT cloud catalogue (service aggregation, discovery and distribution).
- Support the GÉANT community’s adoption of cloud services.

2.2 Structure of GN3plus SA7

To reach those goals and objectives, the SA7 Activity is divided into five Tasks where the project execution takes place:

| Task | Title |
|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Task 1 | Cloud Strategy Developing a common strategy, based on community requirements, shared principles and values; knowledge dissemination and information exchange. |
| Task 2 | Cloud Standards and Interoperability Creating policies, rules and best-practices to establish standards and help ensure interoperability and effectiveness. |
| Task 3 | Cloud Brokerage and Vendor Management By aggregating demand across the community and integrated brokerage and service delivery ((joint requirements, provider engagement, framework contracts, terms and conditions of use, procurement process analysis and implementation), NRENs will be able to get the best possible value from cloud services. |
| Task 4 | Cloud Integration Cloud services radically change the data requirements of users and NRENs and so technical integration with GÉANT’s and NRENs capabilities will ensure consistent performance and reliability. |
| Task 5 | Mobile Services The combination of Mobile access and cloud services offer huge opportunities and so the activity will have a task targeted at providing mobile data network capabilities to GÉANT and NRENs, which suit the needs of education and research. |

This report provides details on the four ‘Cloud Tasks’ (Task 1 to 4). The progress in the field of mobile services (Task 5) is described in a separate report.

2.3 Benefits for the NRENs

SA7 will help NRENs and others in the research and education community to:

- Gain a better understanding of cloud computing and its capabilities.
- Determine how cloud computing relates to an NREN’s own mission and objectives.

- Formulate a cloud strategy.
- Incorporate cloud activities in their roadmaps.
- Include cloud services in an NREN's portfolio.
- Facilitate their user-base in adopting the cloud with the right conditions of use.

Furthermore, SA7 will:

- Align, support and provide synergy in the cloud activities of NRENs.
- Combine the capabilities of the European NRENs to provide more leverage to any type of agreement and request for standardisation.

The Activity seeks to ensure that the combination of a network infrastructure, AAI-middleware and cloud services, facilitated by GÉANT and NRENs, stands as a key technical and financial element in the ecosystem.

SA7's support and expertise facilitates the NRENs' provision of:

- *Choice* (multi-vendor approach: offer multiple services from different cloud providers, both from commercial providers as well as services produced by organisations within the education and research domain) to accommodate the plurality and diversity of the community, a large and varied customer base and users with many different needs and capabilities).
- *Openness and ease of use* (collaborate and share data across organisations and borders in a straightforward way; interoperability between vendors, services and systems).
- *A safe and secure* work and learning environment (user and data protection).

3 Results of Year 1

3.1 SA7 Achievements and Overall Progress

In its first year of the GN3plus project, the SA7 team made good progress. This paragraph provides an overall description, relating the efforts in Year 1 to the goals of SA7. The subsequent chapters provide a breakdown per Task.

The overall goal of SA7 is to ensure that the NRENs aggregate demand and collaborate on clouds to optimally position the NRENs to play an active role with respect to the rapidly developing cloud paradigm, so that the benefits of the cloud can be fully realised and the attendant risks appropriately managed.

The GN3plus Service Activity Support to Clouds (SA7) enables NRENs to deliver cloud and mobile services to their communities, with the right conditions of use.

3.1.1 Aggregate Demand and Collaborate on Clouds

Fourteen NRENs participate in SA7, emphasising the relevance of the topic. These NRENs collaborated actively and in a positive spirit, to establish a joint foundation: a common cloud language, (cross-task) information exchange and approach to work together as NRENs, with cloud providers and other stakeholders. It is the baseline for a sustained cloud effort.

After four months, the team completed a cloud questionnaire, where 23 NRENs provided input on their cloud capabilities and needs. This survey showed that only a small number of NRENs (four respondents) believe they deal with clouds in a well-structured manner. It was also made apparent that there are two ‘views on clouds’; two different paradigms:

- Broker cloud services from providers: consume from others.
- Be a cloud provider: produce cloud services.

Some NRENs strongly favour one of those approaches. Others want to be active in both fields.

The SA7 team works on both views, as each is relevant for the GÉANT community. Building on the outcomes of the questionnaire, the team defined relevant cloud service types for the first GN3plus project year, and aims for a good spread between commercial and community service offerings (to provide choice for a large and diverse population):

Software as a Service

- Collaboration suites, real-time communication and webconferencing
- File storage and synchronisation

Infrastructure as a Service

- Raw storage, compute and virtual machines

The four cloud tasks created ‘building blocks’, which will facilitate NRENs consuming and producing’ these cloud services:

- Task 1: Cloud strategy
- Task 2: Cloud standards and interoperability
- Task 3: Cloud requirements
- Task 4: Cloud integration



Figure 3.1: Overview of Task 1 to 4, which form the base of GN3plus’ work with clouds

3.1.2 Optimally Position the NRENs to Play an Active Role

It quickly became apparent that working together in GÉANT, to aggregate demand and expertise, is welcomed and needed to become a ‘cloud player’. As most NRENs are in a start-up phase for clouds, being able to exchange information with your peers is highly beneficial. Also the NRENs that have been working on cloud services for a number of years benefited from SA7. The larger scale of the joint European approach (compared to national initiatives) opened doors at large cloud providers. The SA7 team was able to engage in conversations with senior management of a considerable number of cloud providers and to translate these contacts into concrete efforts: a first wave of providers (both commercial vendors and providers from with the Education and Research domain) is now working with the SA7 team to adapt their services to the needs of the GÉANT community. Also, the SA7 team made contact with and provided input to the EC cloud activities [[DGCONNECT](#)]. Furthermore, during the year the team was present at a number of events and conferences, to present and discuss the work.

3.1.3 Acknowledge a Rapidly Developing Paradigm

NRENs should be aware of the ‘speed of the cloud’ as well as the adoption rate. Users are already using cloud services and there is a dichotomy between their enthusiasm to embrace ‘free cloud services’ (often without looking properly at the risks involved) and reluctance of institutes to abandon the traditional model of running

services on in-house servers (often without being able to provide the features and agility needed to accommodate users' needs).

3.1.4 Realise Benefits and Manage Attendant Risks

The NRENs have a unique position and opportunity to bridge this gap and to provide a collection of cloud services (brokered and self-produced) that fulfil the requirements from both users and institutes. During the first year of GN3plus, the SA7 team:

- Made the NRENs aware of the need to change and defined recommendations for the organisational transition of NRENs, needed to adopt to the cloud model.
- Described relevant components, standards and protocols to be used for strategy, brokerage and integration work
- Created a first version of a joint set of essential requirements for cloud services: prerequisites which service providers should comply with, when delivering cloud services via GÉANT and the NRENs, to the research and education community (qualification criteria that vendors are expected to meet).
- Provided practical guidance to cloud providers to help them meet these requirements.

3.1.5 Enable NRENs to Deliver Cloud and Mobile Services to their Communities, with the Right Conditions of Use

The team defined a draft version of a cloud distribution model, describing how NRENs can deliver 'approved cloud services' (which meet the joint requirements) to their communities.

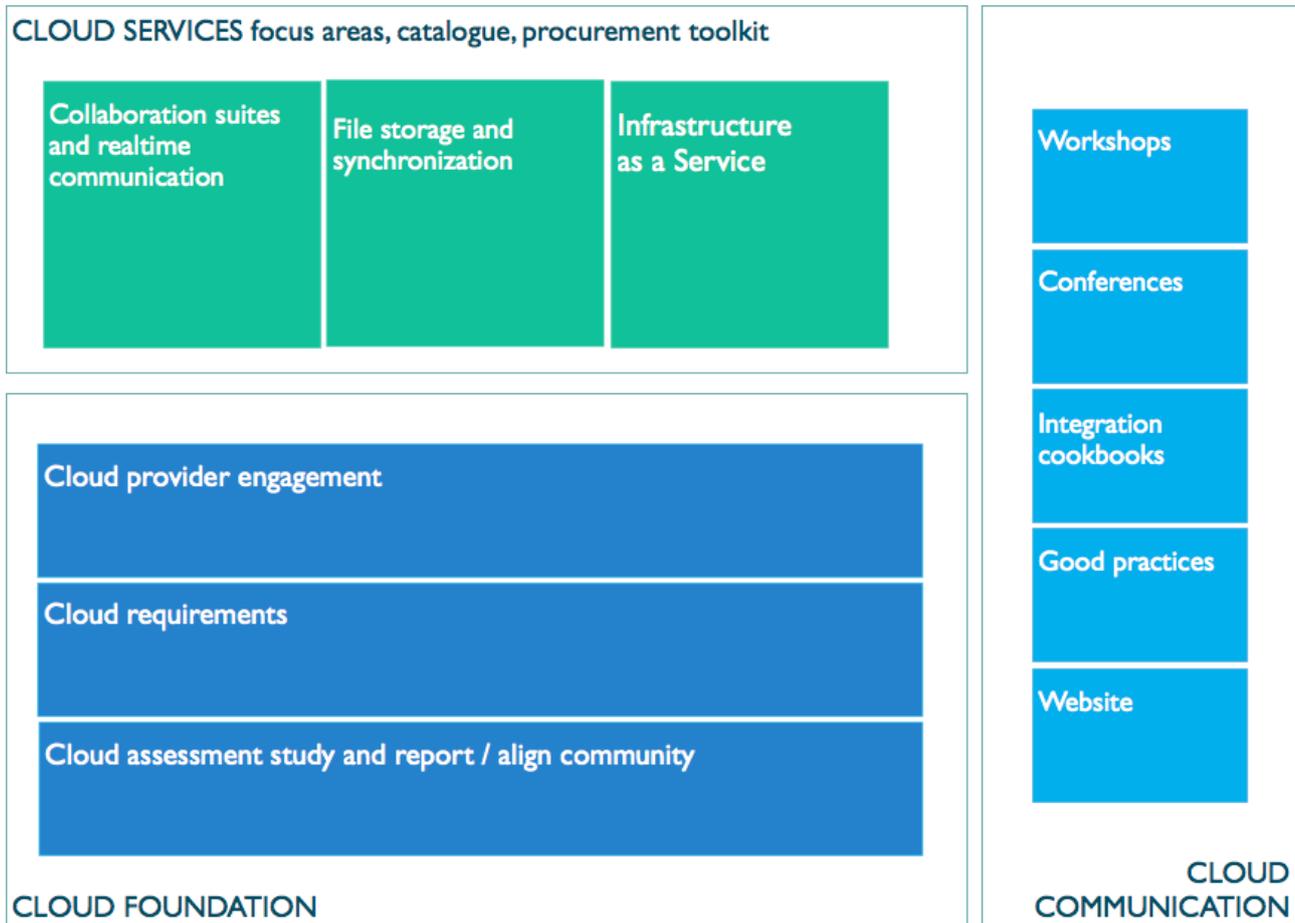


Figure 3.2: Support to clouds: Focus areas

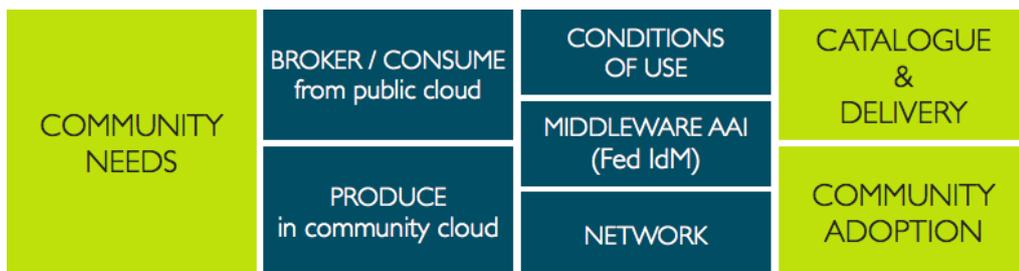


Figure 3.3: The goals of SA7 span all of its Tasks

3.1.6 Highlights

To summarise, there are a number of highlights to outline from the Year 1 work to date:

- NRENs’ willingness to collaborate and transition towards the cloud (willingness).
- The baseline is in place (approach, common language, first version of delivery chain).
- A strong joint effort towards providers made an impact; vendors are interested in offering services to research and education through GÉANT and the NRENs.

3.1.7 Challenges

There are also a number of challenges.

- Cloud services are a new domain for most NRENs and expertise is not easy to find within the GÉANT community (especially for non-technical skills, including vendor management, brokerage and legal expertise). SA7 will foster and try to expand the team.
- Change of distribution model: are NRENs able to cope with the user driven aspect of cloud services? Clouds change the decision-making landscape for IT services. Are NRENs positioned in the right way to connect to these new decision makers? SA7 will continue this discussion and try to shape the path.
- Speed of user adoption: are NRENs able to provide the right alternatives (to the current isolated and individual cloud use) in a timely manner? Can NRENs expand their portfolio to include cloud service delivery elements? SA7 will try to provide the right building blocks, at the right time.
- The outcomes of the questionnaire and NREN interactions show many NRENs want to produce cloud services: to provide cloud services of their own, closely tied to the community. The demand for such services has increased with the growing concerns about data leaks and privacy aspects of public cloud services. SA7 will increase the efforts to facilitate the NRENs with this work and look towards opportunities for collaborative efforts.

SA7 will (continue to) work on these elements in the second year of GN3plus.

3.2 Deliverables and Milestones: Progress Update

| Code | Name | Due date (project month) | % complete | Actual / forecast delivery date | Comments |
|-----------------|---------------------------------------------------------------------|--------------------------|------------|---------------------------------|---------------------------------------------------------------|
| D11.1 (DS7.1.1) | Review of Y1, Tasks 1, 2, 3 and 4 Cloud Activities and Achievements | 31/03/2014 (M12) | 100% | 31/03/14 | Completed <i>This document is the review of SA7 Year 1</i> |
| MS94 (MS7.1.1) | Cloud assessment document | 31/08/13 (M5) | 100% | 31/07/13 | Completed |
| MS96 (MS7.1.2) | Cloud workshop 1 | 31/01/2014 (M10) | 100% | 14/03/14 | Meeting report and review |
| MS97 MS7.3.1 | Cloud brokerage framework available | 31/03/2014 (M12) | 100% | M12 | Document review |

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4 Cloud Strategy

SA7 Task 1 identifies and describes the cloud needs of the community, relates these to the capabilities of the market and community, and recommends a cloud strategy, which can be used by both GÉANT and the NRENS. SA7 Task 1 also establishes knowledge dissemination and information exchange.

SA7 T1 is aiming to establish ongoing interest and enthusiasm, translating into a sustained willingness of the NRENS to collaborate through GÉANT on clouds. SA7 Task 1 strives for organisational alignment on clouds, between the NRENS.

4.1 Progress in Year 1

In July 2013, the team conducted a cloud **questionnaire** and published the results of this questionnaire in a **report (MS94, MS7.1.1)** containing an overview and assessment of the NRENS' current cloud capabilities (available cloud expertise and components) and community needs. It provides an insight into:

- NRENS' perception of clouds.
- Cloud components the NRENS have in place and are planning to consume and produce.
- Opportunities for NRENS to collaborate on clouds through GN3plus, in Support to Clouds (SA7).

The MS94, (MS7.1.1) report is available on the GN3plus intranet.

The outcomes of this report were presented to and discussed with the NREN community at the GÉANT Symposium in a cloud workshop.

- SA7, defining a cloud strategy for GÉANT and the NRENS **cloud workshop session**.
- Also, the team hosted a **webinar** about the work: 'Blue Sky Thinking in the Clouds'.

Using the outcomes of the symposium workshop, webinar and other team and community discussions, the team wrote a **cloud strategy document**. The draft version of this document was discussed at a second **cloud workshop** / seminar in March 2014.

4.1.1 Main Outcomes of the Cloud Questionnaire

The questionnaire had a high response rate (27 respondents from 23 NRENs), reflecting the relevance of cloud services for the NRENs. This was further emphasised by the fact that two-thirds (66%) of the respondents indicate that cloud services have had an impact on their organisation, with 40% stating this impact as "high to very high".

NRENs find cloud services appealing because of their flexibility:

- They allow NRENs to offer and use new services at a faster pace (agility).
- Cloud services can be easily scaled (elasticity).
- Most cloud services are easy to use.

Eighteen of the NRENs (80% of respondents) state that they are already working on cloud-based activities, with 12 of the respondents doing this through one or more specific cloud teams within their organisation. Only four responding NRENs stated that they dealt with clouds in a well-structured manner, with a clear underlying strategy. At the time of the survey (July 2013), most NRENs were still in start-up phase for their cloud efforts. The timing for GN3plus SA7 Support to Clouds was clearly right, however, as 14 NRENs are now working together on cloud-related programmes.

Looking at the demand side of cloud services, the results of the survey indicate that users and decision makers are asking NRENs about cloud services and demonstrating an urgency to deliver services. There are a number of things that NRENs need to establish to fulfil this demand.

- Almost all NRENs believe they should provide and operate their own cloud services (22 responses). The survey indicates that NRENs are willing to share components and offer services provided by other NRENs (ranging from a third to a half, depending on the type of service).
- About half of the responding NRENs want to broker cloud services from commercial providers. A total of 19% of the respondents are already offering one or more services.
- Half of the respondents want to integrate cloud services.

SA7 will facilitate and coordinate collaborative efforts between NRENs and between GÉANT and the NRENs (such as roadmaps and planning and resource sharing to facilitate mutual benefits). It is clear that there are also opportunities to more closely align groups of NRENs (using the results of the questionnaire).

The most attractive services for the research and education community, according to the respondents, are:

- Instantiate individual computing platforms.
- File storage: tools for file sharing, backup and archiving.
- Web conferencing.

The survey shows the main target group for these cloud offerings are the institutions (IT departments of universities). A little over half of the respondents also indicated their intent to offer services directly to individual users.

The main concerns and requirements for cloud services, for NRENs and their communities are:

- Security, privacy and confidentiality issues.
- Support for identity federations.
- Vendor lock-in, lack of control and interoperability through standards (a concern for NRENs, but less for end-users according to the respondents).
- Reliability, availability, data location and replication.
- More choice / greater number of services.
- The sustainability of NREN cloud offerings.

It is also relevant that the respondents indicated that NRENs and their communities are less concerned about "fading of internal competencies" and the financial aspect of "substituting CAPEX with OPEX".

The NRENs clearly want to collaborate with the GÉANT community on cloud knowledge sharing, business models, standards, security (trust, data protection), procurement and brokering, AAI integration and operations. There is less interest in sharing information about the promotion of cloud services and cloud application development.

There is also a realisation that an NREN's failure to provide or facilitate the use of cloud services to their users could either result in users drifting into fragmented islands of incompatible services that may not have a sustainable future, or negatively impact an NREN's relevance and diminish the associated benefits to the user communities.

NRENs would like to get involved in cloud activities, however, some of the constraints they face include: a shortage of resources, both personnel / expertise, and financial limitations. Funding agencies are perceived as having a rather low level of readiness for using cloud and demand for cloud services. This might indicate a need to engage more closely with these organisations.

The SA7 team uses the outcomes of this questionnaire (through further analyses, where needed), to drive and focus the NREN collaboration on clouds and the SA7 work packages.

4.1.2 Cloud Strategy Document

The results from the cloud questionnaire were used for further team discussions, which resulted in a cloud strategy document, describing the cloud landscape and providing recommendations on how NRENs can position themselves.

5 Cloud Standards and Interoperability

SA7 Task 2 investigates and describes the needs of the research and education community regarding interoperability of cloud services. SA7 Task 2 creates policies, rules and best-practices to establish standards and help ensure interoperability and effectiveness.

Underlying the SA7 project components, is the need to establish a sustained commitment from NRENs to collaborate through GÉANT on clouds. The policies, rules and best practices described in SA7 Task 2 provide a solid foundation for this joint effort.

5.1 Progress in Year 1

5.1.1 Best Practice Documents and Recommendations

The team gathered input within the community for standardisation and interoperability, to establish an overview of relevant standards, technical protocols and organisations to engage with. Following this, the team produced the following documentation:

- A document describing a possible cloud distribution model, to deliver services in an easy, safe and secure way.
- **Cloud standards and interoperability document**, which provides an overview of relevant standards, protocols and cloud organisations, useful for strategy, brokerage and integration work. The document was finalised through a discussion with the NREN community at the SA7 cloud seminar in March of 2014.

These documents lay the groundwork for follow up activities targeted at cloud interoperability and data portability. These activities are focussing on interconnecting cloud services and linking them to users and federated identity management systems.

5.1.2 Participation in Other Cloud Projects

The team participated in a workshop organised by the EU FP7-funded Cloud Accountability Project ('A4 cloud project'), looking at accountability, trust, and risk mitigation of cloud services (see [\[WORKSHOP\]](#)).

Members of the SA7 team are (besides their SA7 work; on behalf of their home organisations) active in other cloud initiatives, such as EGI ,Fedcloud, Helix Nebula, Open Nebula, StratusLab and Synnefo. [[EGIFEDCLOUD](#)] [[HELIXNEB](#)] [[OPENNEB](#)] [[STRATUSLAB](#)] [[SYNNEFO](#)]. They are linking these activities to the GÉANT cloud work, to establish knowledge and information exchange and collaborations. Managing directors of the NRENs use the most important results of the SA7 work within organisations, such as e-IRG [[EIRG](#)]. Also, the SA7 work is used and welcomed within the NREN Global CEO Forum [[CEOFORUM](#)]. The SA7 foundation established during the first year, put the GÉANT cloud efforts on the map, provided a basis for discussions with these other cloud-related projects and will help with establishing future cooperation.

The team presented at the “EGI Towards Horizon 2020” workshop, is sharing information with EGI, and is looking at future joint efforts.

The team received an invitation to participate in the Standardisation Forum in the Netherlands and established ties with Euro-CIO (the Chief Information Officer association, representing the demand side for 600 public and private organisations [[EUROCIO](#)]).

5.1.3 EC Contacts

5.1.3.1 DG JUSTICE

In Q2 of 2013, SA7 applied to join an **EC cloud contract expert group** from DG Justice. In Q3, this application was denied, possibly due to the highly specialised legal composition and approach / nature of this group.

5.1.3.2 DG CONNECT

The team established good contacts with DG CONNECT [[DGCONNECT](#)].

- Met in Brussels with the **EC DG CONNECT cloud representatives**, to discuss their cloud activities, the GÉANT work on clouds and possible collaboration. The GÉANT cloud team was invited to join cloud working groups facilitated by the EC, and followed up on this opportunity.
- Participated in a session of the **EC Cloud working group** about service-level agreements in Brussels.
- Provided input for a **report**: Analysis of cloud best practices and pilots for the public sector. [[CLOUDBP](#)] Within this report, the team was able to get a paragraph published, which emphasised the research and education community’s role as a forerunner of cloud services:

“A third pilot area is the research and education sector. This community is actively pursuing the benefits of cloud services, as these help them to collaborate and share data across organisations and national borders. The challenges already mentioned (on procurement, marketplaces, resource pooling, interoperability, security and privacy) all are visible in the research and education sector and are being tackled through several (potentially Pan-European) collaborative efforts. These trans-national activities within a large and open, vertical community, can showcase the EC cloud strategy and emphasize the need to work on clouds on a European level.”

- Visited the **Cloud for Europe conference** in Berlin [[CLOUDEUROPE](#)].
- Responded to a request from the European Cloud Partnership [[ECP](#)] to identify suitable **cloud pilot projects**.

The team wrote a **proposal** to collaborate with the EC on these pilots. GÉANT can apply the EC level cloud components within the European research and education sector. The GÉANT and EC cloud activities are aligned in vision and approach. Both are entering the execution phase, which will facilitate joint efforts on both a legal and technical level. The team is expecting a formal response by the end of March of 2014.

- Provided feedback to a draft version of a Code of Conduct for cloud service providers, published by the C-SIG data protection working group of DG CONNECT.

5.1.4 Horizon 2020

The team is involved with the GÉANT planning and coordination activities for Horizon 2020, to bring NRENs together and link them to other organisations, and where applicable, to send in joint proposals for future work.

6 Cloud Brokerage and Vendor Management

SA7 Task 3 has been established to aggregate demand across the GÉANT community and establish integrated brokerage and service delivery (joint requirements, provider engagement, framework contracts, terms and conditions of use, procurement process analysis and implementation), to ensure NRENs will be able to get the best possible value from cloud services. Task 3 engages with commercial providers and organisations within the Research and Education community that already have cloud services, or are planning to offer cloud services.

SA7 Task 3 works towards a comprehensive portfolio of brokered Cloud Services, which fulfils the needs of the research and education community and has the right conditions of use.

6.1 Progress in Year 1

Following team discussions and in light of the results from the cloud questionnaire in Task 1, the team scoped the work and defined focus areas for the first project year. This process identified cloud services that are most relevant for the research and education community at this stage, including:

- | | |
|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Software as a Service (SaaS) | <ul style="list-style-type: none"> • Collaboration suites, real-time communication and webconferencing • File storage and synchronisation |
| Infrastructure as a Service (IaaS) | <ul style="list-style-type: none"> • Raw storage, compute and virtual machines |

6.1.1 Cloud Requirements Baseline

The SA7 Task 3 team created a document MS97 (MS7.3.1), describing the essential **requirements** cloud service providers should comply with, when delivering cloud services via GÉANT and the NRENs, to the research and education community: to be used as qualification criteria which vendors are expected to meet. This document contains elements from the 'Cloud standards and interoperability' document created in Task 2. The currently described pre-conditions are relevant for all NRENs and provide a European-wide baseline, covering approximately 90% of the elements an individual NREN should put in place. The final 10% are country-specific elements (including national regulations and legislation).

The requirements foundation was discussed extensively with stakeholders within SA7, GN3plus, DANTE, the NRENs and vendors. Using the 'Cloud distribution model' described by Task 2 and the 'Cloud requirements baseline', the Task 3 team worked with the SA6 Task 2 Procurement team, to describe the delivery and procurement chain for cloud services.

6.1.2 GÉANT as Cloud Delivery Gateway and Enabler

Individual research and institutes do not have the required size and expertise to effectively engage with cloud providers. Even for individual NRENs, this has proven a difficult task. By aggregating skills within SA7 and applying scale by talking to vendors on behalf of all NRENs gathered in the GÉANT community, a focused and effective point of contact is made available.

Cloud providers struggle with the effort needed to deliver their services to the Research and Education community. Having discussions with each individual institute is unfeasible. They therefore welcome the approach put forward by GÉANT:

- **On a GÉANT level:**
 - Put in place a European-wide baseline for the provision of cloud services.
 - Provider:
 - Complies with set of joint NREN conditions of use principles (requirements)
 - Connects to the R&E Federated Identity Management systems (eduGAIN) to:
 - (1) Allow users to login with their trusted institutional accounts.
 - (2) Bring access control to institutes.
 - (3) Assure providers only R&E users have access.
 - Establishes a network peering (for applicable services) to get the fastest and most direct data connection.
 - Publish compliant services in an online portfolio, the GÉANT Cloud Catalogue, to show their availability to the community.
- **On a NREN level:**
 - Using the GÉANT baseline and catalogue to put in place national agreements (taking into account national regulations and legislation) and procurement of the services. NRENs can organise joint procurements via GÉANT, where applicable.

Through this approach, GÉANT strives to overcome the current obstacles and uncertainties that prevent a large scale adoption of cloud services within the R&E community. With the SA7 cloud work, GÉANT bridges the gap between the supply and demand side, and offers a route for providers to deliver and the R&E community to adopt cloud services in a clear, responsible and compliant way that is connected to eduGAIN and the GÉANT network.

6.1.3 Vendor Engagement

The team engaged with a range of cloud providers: both commercial vendors and providers from within the GÉANT community. All of which demonstrated their willingness and capabilities in an earlier stage at a national level, working with individual NRENs. SA7 scaled up these national efforts and gathered a set of cloud providers that want to deliver their services to the R&E community through GÉANT and the NRENs.

As shown in Figure 6.1, SA7 connects these providers on three levels / three cloud-connection building blocks:

- Conditions of use (provider complies with requirements document).
- eduGAIN Federated IdM connection (provider links service to eduGAIN).
- Network peering (provider connects to GÉANT network).

Cloud distribution to European education and research

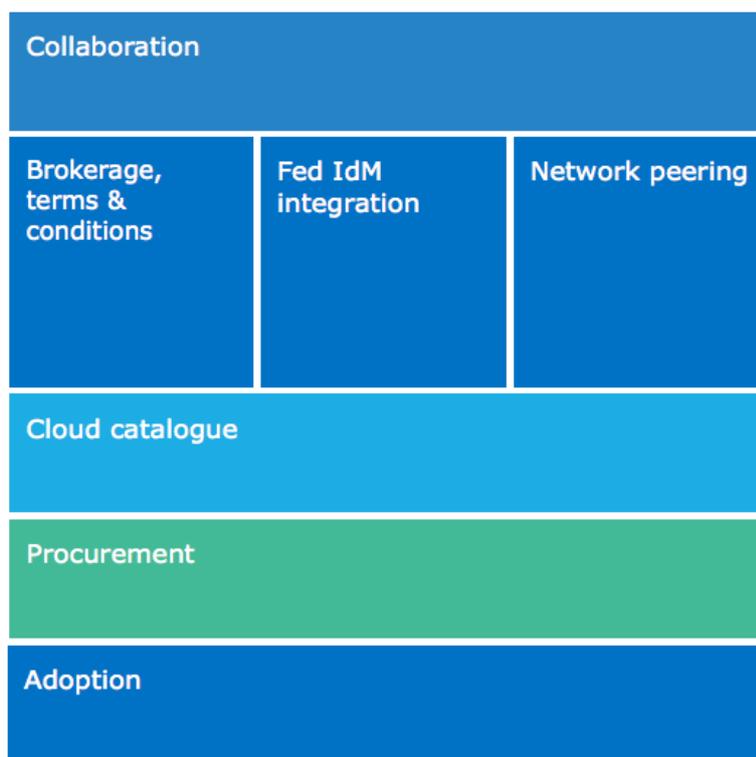


Figure 6.1: Building blocks essential to all cloud services

7 Cloud Integration

SA7 Task 4 facilitates the connection of cloud services to GÉANT and NRENs' IT infrastructure. Cloud services acquired via the Cloud Brokerage and Vendor Management task, (SA7, Task 3), need to be connected to the IT infrastructure of the NREN community, namely, the networks and AAI middleware. This task coordinates and drives the technical integration work.

SA7 Task 4 works towards a comprehensive list of integrated Cloud Services, which fulfil the needs of the research and education community and is connected to the GÉANT and NREN infrastructures.

7.1 Progress in Year 1

7.1.1 Integration Description and Coordination

The team coordinates the cloud integration and bridges the cloud services work with the GN3plus network and middleware activities: to integrate cloud services with GÉANT's network and middleware assets.

Together with stakeholders, the team worked on information for cloud providers, describing how they can connect to the GÉANT and NREN infrastructure (including eduGAIN middleware and the network connections). The team organised GÉANT internal discussions on the current cloud integration capabilities of the GÉANT assets (middleware and network) and how to expand these capabilities.

SA7 collaborated with SA5 to facilitate the eduGAIN connection process for cloud providers. SA7 created a Virtual Home Organisation (VHO), operated by GRNET, where cloud providers can get testing accounts in order to work on their integration. SA5 is at the same time looking at ways of streamlining the publishing of new services through eduGAIN. Further developments on this aspect of cloud integration will take place in the second year of the project.

7.1.2 Vendor Interactions

The SA7 team is closely involved in discussions with cloud providers (collaborates with Task 3), to inform these providers about the integration opportunities and how these connections can be put in place.

7.1.3 Cloud Catalogue

The SA7 team is also looking at the requirements and different options for creating a **cloud catalogue**, a website where brokered services (services that fulfil / are compliant with the cloud requirements baseline, delivered by Task 3) will be presented to the community. This directory of services, illustrating the cloud portfolio, has been identified as a required component in the discussions within SA7, and is described by Task 2 in the *Cloud Delivery Model* document'.

As the number of providers delivering their services through GÉANT increases, it becomes more important to have such a catalogue in place, where users can browse the existing, approved services, see what is available to them, search for services, etc. With this in mind, the SA7 team has started a possible design of the cloud catalogue

This 'showroom' is not a part of the initial SA7 PID. The team is looking at the opportunities of weaving this catalogue into the work for Year 2 and will write a proposal for actual development of the cloud catalogue, to be discussed with the GN3plus Project Management and Services Advisory Board.

7.1.4 Virtual Machines Migration

The SA7 team is orchestrating an effort by GRNET and PSNC, later joined by CARNet, to perform long-distance migration of Virtual Machines between different data centres. This work package will investigate the feasibility of two migration types:

- Live migration, where a running Virtual Machine is transferred between two NREN locations without it being shut down, and in a manner transparent to the user.
- Migration of snapshot images, which can enable failover and disaster recover scenarios.

This effort (to be executed in Year 2) shows the combined power of cloud services and the GÉANT network: to leverage the GÉANT network capabilities and provide guidance and policies for sharing computing resources between different organisations.

8 Communication

A range of communications activities took place during the first year of SA7, the Cloud Team

- Kicked-off work with a two-day cloud discussion and workshop session for the whole team at SWITCH in Zürich.
- Was involved in writing a cloud article for the GÉANT Connect magazine [\[CONNECT\]](#).
- Had regular update meetings with the DANTE Partner Relations team to establish a good information exchange with the NRENs about the cloud developments.
- Participated in and presented at two TERENA TF-Storage meetings (in Berlin and Brussels).
- Presented at the Nordic e-Infrastructure Conference 2013 (13–16 May in Trondheim) [\[EINFRASTRUCTURE\]](#).
- Wrote a cloud white paper, and presented at the EUNIS 2013 conference in Riga, Latvia on 12–14 June 2013 [\[EUNIS\]](#).
- Updated the attendants at the TERENA Task Force on Management of Service Portfolios (TF-MSP) meeting in Alcalá.
- Wrote a proposal to present at the EC ICT 2013 conference. The proposal was accepted.
- Presented at the TERENA (TF-MSP) meeting in Trondheim.
- Presented about the GÉANT cloud work at the GN3plus Symposium in Vienna:
- Connecting the Clouds 1 (meeting to update the GN3plus project group about progress in SA7 and discuss how to deliver a seamless cloud experience).



- Connecting the Clouds 2 (a second meeting to allow for a more-detailed discussion about how to incorporate the ideas generated in the Connecting the Clouds 1 session into the SA7 tasks and discuss cross-activity collaboration (link SA7 work with other GN3plus activities).
- Delivered a cloud workshop session about defining a cloud strategy for GÉANT and the NRENs.
- Chaired a networking session at the **EC ICT 2013** conference in Vilnius; “How cloud services can benefit the R&E community and how effective public-private partnerships can help drive innovation and take-up of cloud services” [[ECICT](#)].
- Presented at the **EGI** towards Horizon 2020 workshop [[EGI2020](#)].
- Presented at the **CARNET Users Conference** in Zagreb [[CARNET](#)].
- Hosted a cloud session at the EC **Future Internet Assembly conference** in Athens (18–20 March 2014) [[FUTUREINT](#)].
- Prepared to be present at the **Terena Networking Conference 2014**. TNC 2014 is an opportunity to show the cloud services SA7 is working on and further interact with the community about their needs and use cases. Also vendors can be invited to get acquainted with the community.
- Participated with all SA7 task leaders and the activity leader in the Leading High-Performance Teams Training’ in Amsterdam [[HIGHPERF](#)].
- Prepared a website to communicate externally about the GÉANT cloud activity.
- Concluded the first year of GN3plus SA7 and looked forward to the final year, with a second cloud workshop for the whole team, again in Zürich.

9 Preview of GN3plus SA7 Year 2

After laying the groundwork in Year 1, in the second year of GN3plus, the team will use the building blocks described in this report, to maintain the good collaborative spirit, further progress on the delivery of cloud services and work with stakeholders on:

- Strategy and organisational change.
- Community needs.
- Standards and interoperability.
- Cloud provider engagement.
- Cloud services integration (eduGAIN connections and network peerings)
- Cloud distribution (via a Cloud Catalogue).

These Year 2 activities are targeted at moving towards an operational / **production stage**. An initial set of attractive cloud services will be made available and presented in the form of a Cloud Catalogue. The team will increase efforts to encourage and facilitate NRENs to produce community cloud services together (community cloud offerings).

The team is also looking at setting up a new task (Task 6), specifically targeted at Cloud adoption. The task will focus on strengthening the distribution capabilities of the NRENs and help institutes to acquire and use cloud services. By adding this task, the distribution chain can be completed: collaborative efforts in GÉANT on putting cloud services 'on the shelves' (available with the right conditions of use) and getting them 'off the shelves', into the hands of the users.

Appendix A **GÉANT and Cloud Background**

A.1 **Why Clouds in GN3plus?**

The cloud will become the default model for distributing online services, as it is the most effective and efficient delivery mechanism. A new generation of users in the Research and Education sector has grown up 'choosing their own devices and services'. Cloud services come natural to them.

Cloud services empower users to select and use the services they really want, in an easy and often economically attractive manner. Research and education organisations can become more agile and provide their users with a wider range of relevant IT services at a faster pace, thus facilitating dynamic collaborations between teams and across borders.

However, the standard delivery of cloud services is often incompatible with the requirements and working methods of the higher education and research community. There are significant challenges on trust, security, privacy, legislation, procurement and interoperability. Individual users and institutes are not able to establish and manage the required conditions of use (due to lack of scale and required expertise). There is the risk that users and institutes could drift off into isolated data islands. To overcome these challenges, the NRENs must work together to deliver and enable the use of public and community cloud services in an integrated way and through a coordinated effort.

In the GÉANT community, the SA7 team must:

- Connect the clouds and make them available with the right conditions of use.
- Communicate with our community about their needs and the opportunities we provide them, to use the cloud in an easy as well as safe and secure way.
- Collaborate with stakeholders within research and education, in the public domain, with private companies (cloud providers), regulators and with the EC, to represent the interests of our community and accelerate and manage the delivery of advanced cloud technology to Europe.

A.1.1 Essential Cloud Characteristics

Empower

- Users to consume the online services they want and need (users are choosers).
Demand side

Disrupt

- The traditional software distribution model and supply chain.
Supply side

Collaborate

Require collaboration between research and education organisations, to:

- Prevent cloud fragmentation.
- Provide ease of use, interoperability and security.
Community effort



A.1.1.1 Software and Cloud Supply Chain

The traditional software supply chain is extensive, as it involves (in its most elaborate form):

- Supplier
 - Producing the software
 - Printing it on physical carriers: CD-ROM, DVD.
 - Shipping physical carriers to regional distribution centres.
 - Selling the product via resellers and shops.
- Customer
 - Buying the product.
 - Installing the product on local servers.
 - Maintaining and managing the local servers.



Figure A.1: Traditional supply chain, CD-ROM distribution, on-premises hosting

The cloud supply chain is most simpler (in its most basic form):

- Supplier
 - Producing the product.
 - Installing it on owned or rented servers.
 - Maintaining and managing the product and server infrastructure.
- Customer
 - Acquiring access to the product by means of a service subscription (often in a pay-per-use form) and capable internet connection.



Figure A.2: New supply chain; cloud distribution model

In theory this is the purest model, where supply and demand meet in the most direct way. It is, however, deceptively simple. In practice both the supply and demand side struggle to make the right connections: there is a delivery gap, and as described in this document, there is a need for organisations that can bridge this chasm and connect the cloud supply and demand side. GÉANT wants to be this cloud gateway, enabler and facilitator between Research and Education in Europe and commercial and community cloud providers.

A.2 NREN Collaboration on Clouds, Starting Point

A.2.1 Why Increase Cloud Awareness?

NRENs are aware of the power of the cloud distribution model and the need to get involved in this field. The next two sections describe the opportunities and challenges presented by cloud services.

A.2.1.1 Opportunities

Cloud services offer higher education and research organisations the opportunity to become more agile and provide their users with a wider range of relevant IT services at a faster pace and fulfil user demand.

IT departments can use the instant availability and elasticity of cloud services (rapid expansion or contraction of capacity) to reduce development time and modify their expenditure profile, thereby reducing the need for periodic and large capital expenditure (CAPEX) and transitioning to a smoother, increased, more predictable operational expenditure (OPEX, pay-per-use model).

A.2.1.2 Challenges

The standard delivery of cloud services by commercial organisations is often incompatible with the requirements of higher education and research. As previously mentioned, there are significant challenges on trust, security, privacy, legislation, procurement and regulation. These issues have different implications between cloud services used in a private capacity, compared to services used within an education or research environment, where the ownership of data and the need to ensure strong custodial control are important.

There are also issues regarding data portability and interoperability and the sustainability of data. Vendors have a commercial imperative to maintain users and reduce churn within their user base, and so, have little incentive to collaborate with competitors on these issues. There is also considerable costs involved with moving high volumes of data between clouds and switching providers.

The cloud is evolving rapidly. Users are making choices now. In its most basic form and from a user perspective, the cloud is about consuming ready to use online services, provided by external providers, through a pay-per-use model. There is a real danger that if NRENs and institutions do nothing, users will drift into fragmented islands of incompatible services that may not have a sustainable future.

A.2.2 Transition to the Cloud, TERENA ASPIRE Study on Clouds

The TERENA ASPIRE study *The Adoption of Cloud Services*, was a predecessor to GN3plus SA7 Support to Clouds. A summary of the transition to the cloud, taken from the ASPIRE study [[ASPIRE](#)].

A.2.2.1 Assessing Cloud Willingness

The cloud affects all levels of an NREN's portfolio:

- Network.
- Middleware (authentication and authorisation).
- Services (consumed from external providers and produced in-house).
- Adoption, marketing and communication.

The NRENs are aware the cloud is a cross-border phenomenon, which has a major impact on all NRENs and on the whole research and education community. NRENs see the need for a coordinated, joint approach; to collaborate on cloud on a European level. The Support to clouds Activity in GN3plus enables the European NREN community establish such a united front.

At the end of 2012, 14 NRENs signed up to actively participate in the Support to Clouds Activity (SA7). Several other NRENs participated indirectly as part of the cloud Tasks, but do provide input. This broad community effort shows the commitment to collaborate on clouds and the relevance of this topic. It also stresses the urgency of the cloud. Numerous NRENs are actively encouraged by their local community to facilitate the cloud distribution model. Their stakeholders want to see the cloud in action. The time for NRENs to act is now. SA7 will help NRENs deliver cloud services and transfer knowledge from NRENs which already have experience in this field, to NRENs which are starting with clouds. This consists technical capabilities as well as establishing the right organisational position to become a cloud hub and gateway.

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Glossary

| | |
|----------------|-----------------------------------------------------------------------------------------------------------------------|
| AAI | Authentication and Authorisation Infrastructure |
| IdM | Identity Management |
| CAPEX | Capital Expenditure |
| ECP | European Cloud Partnership |
| EGI | European Grid Infrastructure |
| EMEA | Europe, Middle East and Africa |
| GN3plus | GÉANT Network 3 plus, a project part-funded from the EC's Seventh Framework Programme under Grant Agreement No.605243 |
| IaaS | Infrastructure as a Service |
| IdM | Identity Management |
| MSP | Management of Service Portfolios |
| NREN | National Research and Education Network |
| OPEX | Operational Expenditure |
| PID | Project Initiation Document |
| R&E | Research and Education |
| SA | Service Activity |
| SaaS | Software as a Service |
| STaaS | Storage as a Service |
| TF | Task Force |
| TNC | Terena Networking Conference |
| VHO | Virtual Home Organisation |
| WP | Work Package |