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Deliverable D11.3 (DS7.1.1,2) Review of Y2 Tasks 1, 2, 3, 4 and 6 Cloud Activities and Achievements



Deliverable D11.3 (DS7.1.1,2)

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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 2 progress for Task 1-4 and 6 (not T5), which involves both organisational as well as technical aspects of cloud services.

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Executive Summary

Through Service Activity 7 (SA7), NRENs from the GÉANT community put in place a strong collaboration on clouds, aimed at delivering online services with the right conditions of use to the Research and Education community, to remove obstacles (issues on trust, technical integration, purchasing and billing) and enable large-scale use.

The NRENs established a joint approach, supported by a strategy baseline for organisational change and standardisation efforts for technical interoperability, to jointly consume clouds from commercial providers (outsourced solutions) and produce cloud services (insourced solutions). This hybrid model accommodates the aspect of choice: the GÉANT community has many different needs for online services they want to use. It also takes into account the element of control: the community wants to use cloud services via their trusted partner, their NREN.

In SA7, the NRENs interacted with cloud providers. The ability to speak with one voice, combined with a clear set of cloud requirements, demonstrated to suppliers that GÉANT is an efficient delivery vehicle and single route to market. The providers' response to the invitation outlining the community's requirements resulted in development of a Cloud Catalogue that outlines the parameters of fourteen services:

- **File storage and sync:** BOX, Crashplan, Shareplan.
- **IaaS:** Advania, CloudSigma, Eduzone EZ-Infrastructure, GRNET Okeanos, Google IaaS services, Microsoft Azure.
- **Collaboration suites:** Microsoft Office 365, EduZone EZ-Moodle, Google Apps
- **Other:** EduZone EZ-AntiSPAM, Netskope Cloud Access Security Brokerage.

In addition, there are network peerings (non-production status) in place with six providers:

- Providers from Helix Nebula: ATOS, CloudSigma, Interoute, T-Systems.
- BOX.
- EduZone.

The catalogue clarifies capabilities of the providers (to which extent can they meet the needs of the NRENs) and thus helps the R&E community to find and select suitable services.

SA7 extended the approach of aggregated demand, towards the procurement stage and invited the NRENs for a collective IaaS tender. Sixteen NRENs joined this initiative, to act as one and establish conditions of use that allow R&E organisations to buy cloud services at an affordable price, through a purchasing model that suits their

financial structures. End users in the R&E sector do not have credit cards; purchase-order based ordering, metering and billing systems are needed on an institutional level. In addition, institutions also require ‘bill-shock’ prevention. Data ingress and egress costs, charged by providers (for data transfer) make the bills too unpredictable and costs can quickly add up. Through network peerings and demand aggregation, GÉANT can reduce those network charges and achieve more predictable cost models. Many providers (including companies such as Amazon, BOX, Code42, Google and Microsoft) welcome the approach to use GÉANT as their starting point for service delivery. Through this work, SA7 transitioned from a recommendation role into a transactional role.

For in-house cloud services, SA7 brought together groups of NRENs to collaborate on technical and organisational aspects. There are high levels of trust between Research and Education organisations and NRENs, and an R&E organisation will often ask its NREN to be both cloud broker and provider. Groups of NRENs are collaborating through SA7 on file storage platforms and IaaS solutions. GRNET has made its Okeanos IaaS service [OKEANOS] available to the European R&E community, and RENATER is offering its Rendez-Vous web conferencing solution [RENDEZVOUS] to other NRENs. Several NRENs, including CARNET and CESNET are offering the Microsoft Office 365 collaboration suite to their community; using the public cloud and through a hybrid model where the Office 365 software runs on-premise in the NREN datacentre, keeping data in the country [OFFICE365].

SA7 collaborated with other e-Infrastructures, including EGI, and gatherings of the Earth- and life sciences. Participation in a large number of meetings was needed to represent the work.

Through this collective effort, SA7 contributed to the European single digital market, clarity on clouds and more favourable conditions of use, to help the GÉANT community adopt cloud services in a predictable and affordable way, that meets their needs. GÉANT is providing a unique service with this combination of demand aggregation and economies of scale, technical and organisational assets, legal, procurement and business development expertise.

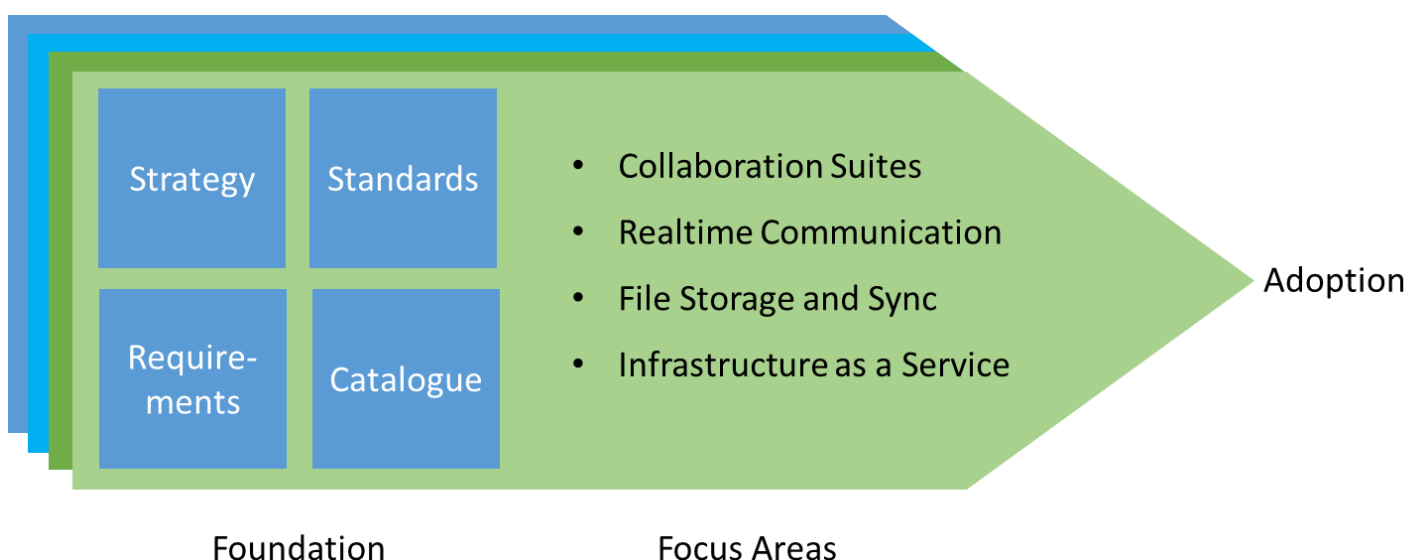


Figure 1.1: SA7’s aim to foster collaborations that enable and facilitate GÉANT’s use of online services (make, buy, in house and outsourced)

1 Introduction

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

Section 2 reminds the reader of the objectives of SA7 Task 1, 2, 3, 4 and 6.

Section 3 outlines the GÉANT community's cloud needs.

Section 4 provides a view of the inputs to the strategy support and the GÉANT Cloud Catalogue.

Section 5 details the areas considered for collaboration.

Section 6 includes details of the communication activities supporting the work.

Section 7 summarises the lessons learned from this work.

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

2 Goal and Planning

2.1 Delivery of Online Services

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

The SA7 team:

- Raised awareness about the opportunities and threats of cloud services and the need for NRENs to collaborate on clouds.
- Aligned NRENs (based on willingness to collaborate), and created a 'cloud foundation':
 - Aggregated demand and engaged cloud providers.
 - Integrated the cloud services with each other and the NREN network and middleware AAI assets, through close collaboration with vendors and network and middleware GN3plus Activities.
 - Listed providers' capabilities in a *GÉANT Cloud Catalogue* (service aggregation and discovery).
 - Supported the GÉANT community to adopt cloud services.

2.2 Structure of GN3plus SA7

To reach those goals and objectives, the SA7 Activity was divided into six, project-execution Tasks.

- 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.

- Task 6: Cloud Adoption (added during Year 2)

Delivering cloud services which are made available via the other SA7 Tasks, to the R&E community, by providing NRENs with the capabilities to distribute these cloud services and assisting institutions with the consumption of these cloud services.

This report provides details on the five 'Cloud Tasks' (Task 1, 2, 3, 4 and 6). The progress in the field of mobile services (Task 5) is described in a separate report [\[D11.4\]](#).

3 Towards the Clouds, Together

The GN3plus SA7 cloud activity has established a strong community collaboration on cloud-based online services. These joint efforts have improved NRENs' ability to deliver cloud services to their user communities with the right conditions of use, and helped the sector benefit from using online services and staying at the leading edge of new and innovative developments.

SA7 and GÉANT do not build or operate cloud infrastructures. Instead, focus is placed on distributing online services built and operated by others, including NRENs, other e-Infrastructures, R&E organisations and commercial suppliers, to the research and education community. Using the GÉANT community's skills and assets, SA7 provides the delivery vehicle to overcome the obstacles which currently prevent the research and education community from using clouds on a large scale.

SA7 facilitates R&E access to the power and flexibility of cloud services through joint cloud brokerage, procurement, integration and adoption efforts.

- Any cloud provider is invited to work with SA7, and if it answers the indicative requirements mentioned in Section 4.3, can be listed in the Cloud Catalogue. SA7 aggregates expertise and demand, (aligns NREN roadmaps and brings a large volume in terms of represented users) as the delivery gateway to establish a direct connection with the European research and education community and deliver their services.
- NRENs have been delivering online services to their communities for many years, and are transitioning to the cloud distribution model, as they see this as strategically important.
- Institutions and users in the Research and Education domain ask their NRENs to deliver cloud solutions, as the NRENs are their trusted advisors, brokers and providers.

Clouds and online services need to be accessible, safe, integrated, affordable, predictable and easy to use. Through the joint NREN efforts in SA7, a suitable online service supply chain can be established to achieve large-scale adoption.

3.1 Community Needs

Organisational, technical and financial structures used by Research and Education institutions do not easily integrate with the way cloud providers offer their services. The needs specific to R&E organisations for clouds services, gathered through the SA7 interactions. In summary, to be able to 'get into the clouds' and start using online services, clarity and assurances must be in place.

3.1.1 Terms and Conditions

Data needs to be handled safely and securely, meeting European and national legislation and regulations. Conditions of use must be transparent, which will overcome the biggest obstacle of using clouds: trust and security.

The work carried out in SA7 helped to improve trust and security through:

- The joint NREN requirements document, clearly describing pre-conditions in this domain.
- Interaction with the EC and other e-Infrastructure organisations to exchange knowledge in this area.
- Focused provider engagement (NRENs acting together and speaking with one voice), inviting them to show their capabilities and listing those in the cloud catalogue.
- Joint NREN procurement (started in GN3plus, to be completed in future projects).

3.1.2 Purchase Models and Reducing Costs

Purchasing models for buying cloud services must match the financial structures in Research and Education, for instance, users in R&E institutions do not have access to company credit cards. Cloud services have to be acquired through the institutions' purchasing structures, meeting procurement and tender regulations. In addition, the payment structures offered by cloud providers are too unpredictable, as they contain variable cost components (network ingress and egress charges). The large opex component conflicts with the capex-driven R&E funding. To prevent the (fear of a) bill shock, predictable cost models and purchase-order-based systems are needed.

The variable costs of services can be reduced by limiting network traffic charges (data ingress and egress), through peering arrangements and connecting cloud providers to the GÉANT network.

The work carried out in SA7 improved this topic by:

- Aggregating expertise in this area (which is hard to find within the community) within the SA7 team.
- Provider engagement, the requirements and cloud catalogue.
- Joint delivery and procurement efforts, including an IaaS procurement, which is currently in progress at the time of writing (March 2015).

3.1.3 Technical Integration

Network peerings also offer technical benefits, in terms of latency and bandwidth, by establishing the best and most direct network connection between the provider and the R&E community.

For user management and access, the community wants to log in to cloud services with a trusted institutional account. By connecting cloud providers to our eduGAIN identity management system, GÉANT and the NRENs provide this federated, single sign-on feature, which:

- Is convenient for users, as it allows them to log-in to many cloud services using one account.
- Gives granular access management to institutions: the R&E organisations control the user accounts and can revoke access to all connected (cloud) services for a user when required, by simply blocking the account in their database.
- Provides assurance to cloud providers, since the eligibility of our users is guaranteed. Without such an identity management platform, every online service would need a separate user database, which is unmanageable.

Network peerings and eduGAIN bring cloud providers into the heart of the Research and Education domain.

SA7 contributed to improving this topic by:

- Providing information to providers on the relevance of these connections; *why* should they care and invest in these links and *how* they can connect.
- Helping to establish the actual connections, by linking the teams involved within GÉANT and the NRENs (other GN3plus Activities, operational teams) as well as those at the providers' side.

3.1.4 Data Portability

Members of the GÉANT community need to be able to 'get out of a cloud' when required or desired, and move to another provider or solution. Data and metadata owned by our community and held by cloud providers must be easy to export and delete.

SA7 contributed to improving this topic by:

- Gathering suitable standards and protocols.
- Advocating their use at meetings and conferences.

4 Cloud Foundation

SA7 has established the foundation for the right conditions of cloud service use. It consists of four components:

- A **strategy** document, The *NREN Cloud Strategy Guide*, to inform and align NRENs in their *organisational* shift towards the cloud distribution model.
- A collection of **standards**, to achieve *technical* interoperability between cloud services, the network and the middleware identity management layer.
- A set of core **requirements** for cloud providers, describing the community needs (including terms and conditions, technical network and identity management integration).
- The *GÉANT Cloud Catalogue*, which is an online service directory website, listing providers' responses to the requirements, which clarifies the extent to which they can meet our needs [\[CATALOGUE\]](#).

4.1 Strategy Guide and Strategic Collaboration

The *NREN Cloud Strategy Guide* (a support document located in the SA7 area of the GN3plus intranet) brings a joint *organisational* approach to transition to the cloud distribution model.

The GÉANT *MS94 (MS7.1.1) Cloud Assessment Document* completed in Year 1 (available on the GN3plus intranet) showed that clouds cannot be considered as an asset that only affects, or can be owned by one organisation. It is a distribution model which impacts all organisations involved with IT. Users and peers perceive NRENs as a trusted party, delivering online services for many years. It is now the right time for these NRENs to transition to a cloud distribution model.

Cloud services are disruptive, as they empower users and change the traditional service delivery chain. The cloud market is experiencing an initial growth spurt, with organisations scrambling to claim their position, before a cyclical growth stage will set-in. NRENs have the opportunity to be in a unique position within this cloud ecosystem. The R&E community asks NRENs to fulfil this role.

The supply and demand sides are struggling to create the right connections and conditions. NRENs can bridge the current gap between sides by facilitating and accelerating the delivery and adoption of cloud services with the right conditions of use: linking providers to the core assets (network and AAI middleware), brokering agreements and procuring services together, and by helping the community with adoption.

The responses to the Cloud Assessment and interactions within SA7 have made it clear that a majority of NRENs perceive cloud services as a considerable shift, which require NRENs to recognise and adapt their business, service and even organisation models accordingly. A key conclusion is that NRENs have now moved beyond asking “If clouds...?” or “Why clouds...?” and are now facing the questions of “What cloud services are required?” and “How to deliver them?”

During the GN3plus timeframe, a considerable number of NRENs discussed clouds with their communities. The R&E organisations made it clear they:

- Saw the benefits of cloud services, but need assurances.
- Want NRENs to provide trust and control by being the cloud advisor, broker and provider for:
 - Deals with commercial public cloud providers; outsourcing services.
 - In-house cloud services built and operated by the NRENs.

There are pros and cons with cloud services. Service delivery and update is fast, there is good elasticity (adaptability provisioning and provisioning resources) and pay-per-use options make it an economical choice. Data, however, is maintained outside of an organisation, trust and control must be provided and interoperability and data portability can be challenging.

The interactions in and through the SA7 Tasks made it clear that a joint approach between NRENs and vendors is needed because of:

- The user-driven aspect of clouds and the diversity of the user-base: users want to choose the services that fit their needs.
- The complexity of the topic (the right expertise is scarce) and speed of new developments.
- The volume aspect: becoming a cloud player requires size and clout.

The Tasks have forged a collective approach between NRENs and suppliers to work on clouds, to share expertise and learn and evolve together. This includes moving ‘up the stack’ to offer more than the network, by providing more advanced online and middleware services to support the complex and evolving requirements of the end user institutions. By combining efforts, NRENs use and develop new and innovative services for their clients that would not otherwise be possible.

The cloud strategy document does not describe a single solution, as NRENs and the organisations they represent have different requirements at different points in time. Also, for clouds in the R&E domain, there is no single “right way of doing things”, 10 000 institutions and 50 million users present a range of needs and preferences.

The strategy document guides an NREN's strategy and tactics in relation to cloud services. It also provides a toolkit based on the experience and lessons learned by NRENs, and has helped the SA7 team identify or address key questions such as:

- What cloud services should NRENs and their communities consider?
- Which deployment models are most effective (e.g. public, private, hybrid, community)?
- Build and buy and the role of brokering cloud services.
- Operational model e.g. own resources, outsourced managed service.

- Collaboration with other NRENs.
- What will be the impact of the cloud distribution model on the organisation e.g. resources and skillsets.
- Business case and financial models and funding aspects.

The cloud strategy document is available to project participants in the SA7 section of the GN3plus intranet.

4.2 Standards

SA7 facilitated knowledge sharing and promoted interoperability through standards across the sector, to prevent walled gardens. The SA7 team created a standards document and website, which defined and described essential *technical* protocols to achieve interoperability. The team gathered input within the community for standardisation and interoperability, to establish an overview of relevant standards, technical protocols and list of organisations to contact/partner.

The knowledge base draws upon:

- Real-world infrastructures (incl. first-hand experience)
- Trends in standards and protocols
- Case studies

Mapping areas:

- Technical standards
- Standards organisations
- Related work by other projects
- Industrial standards (a.k.a. de-facto standards)
- Case studies
- Interoperability tools
- SLA guidelines
- Legal case studies

Members of the team are involved with the OCCI working group, EGI FedCloud and other interoperable cloud infrastructures.

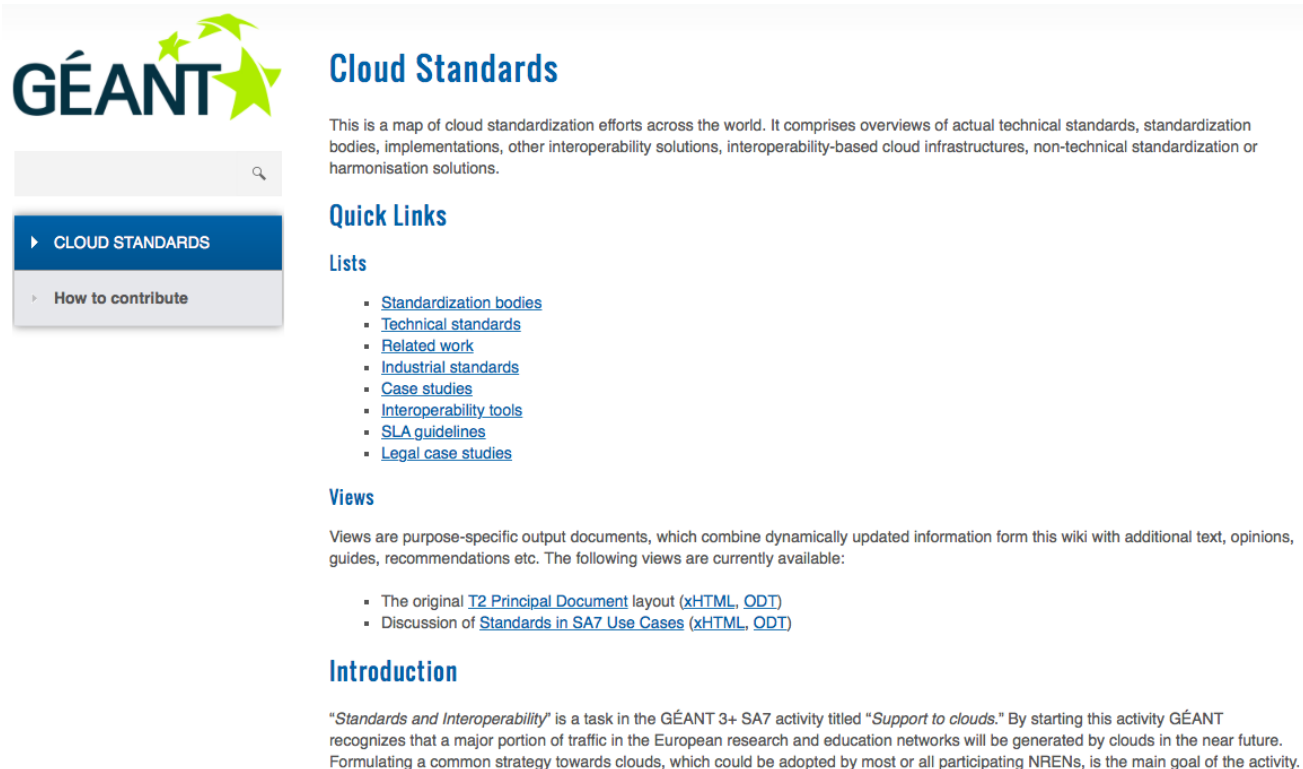


Figure 4.1: Screenshot of GÉANT standards document website [\[CLOUDSTAND\]](#)

The website is public, and editing of documents is possible after authenticating through eduGAIN.

4.3 Requirements

The requirements document ("GN3plus Support to Clouds: Indicative Requirements for Cloud Service Providers") is a coordinated list of pan-European core requirements that cloud service providers are expected to meet. These pre-conditions cover the following fields:

- Intellectual property rights and ownership
- Legal aspects
- Security
- Continuity
- Confidentiality
- Communication
- Billing
- Technical requirements.

The joint set of core cloud requirements is available at: [\[SERVICES\]](#).

4.4 GÉANT Cloud Catalogue

Based on the outcomes of the cloud questionnaire, conducted in the first year of GN3plus, SA7 identified four areas of focus: collaboration software suites, file storage and sync, Infrastructure as a Service (IaaS) and realtime communication. As part of the vendor engagement, cloud providers were invited (including a Prior Information Notice in the Official Journal of the European Union), to list their cloud services in the GÉANT Cloud Catalogue [\[CATALOGUE\]](#), to present these to the research and education community.

The selection criteria for the online directory is the coordinated list of pan-European core requirements described in the previous chapter, which cloud service providers are expected to meet. These pre-conditions cover the following fields: intellectual property rights and ownership, legal aspects, security, continuity, confidentiality, communication, billing and technical requirements. This requirements list provides suppliers with objectives and contractual positions that GÉANT members will be seeking in future commercial relationships with suppliers, which helps providers to understand how to offer their services to the research and education market.

The GÉANT Cloud Catalogue shows the providers' responses to the requirements: it contains structured listings of cloud providers' answers to the requirements. The providers self-assess their ability to meet the SA7 requirements and send in their response based on a red / amber / green (RAG) scoring system of each of the indicative elements identified in the requirements document:

- Green: supplier fully complies with / meets the requirement.
- Amber: supplier partially complies with / meets the requirement and explains the difference through a concise descriptive text.
- Red: supplier does not comply with / does not meet the requirement.

Providers that offer multiple services send in a response for each of those services, since parameters can be different.

The cloud catalogue offers the research and education community clarity about providers' capabilities and they can be compared against each other (against a single set of questions). The catalogue can be used by NRENs and Research and Education institutions for their internal processes when procuring cloud services (subject always to domestic procurement legislation and applicable EU threshold values). The catalogue is not an online shop where users can buy services. It is up to cloud providers to bring these capabilities. The catalogue is a tool that supports research and education network providers and institutions across Europe with their procurement of services from the cloud, as it allows R&E institutions to select services that meet their needs and contact the right teams at the providers: It fulfils a *recommendation* role.

Many cloud providers welcomed this approach and at the end of GN3plus fourteen services were listed in the catalogue:

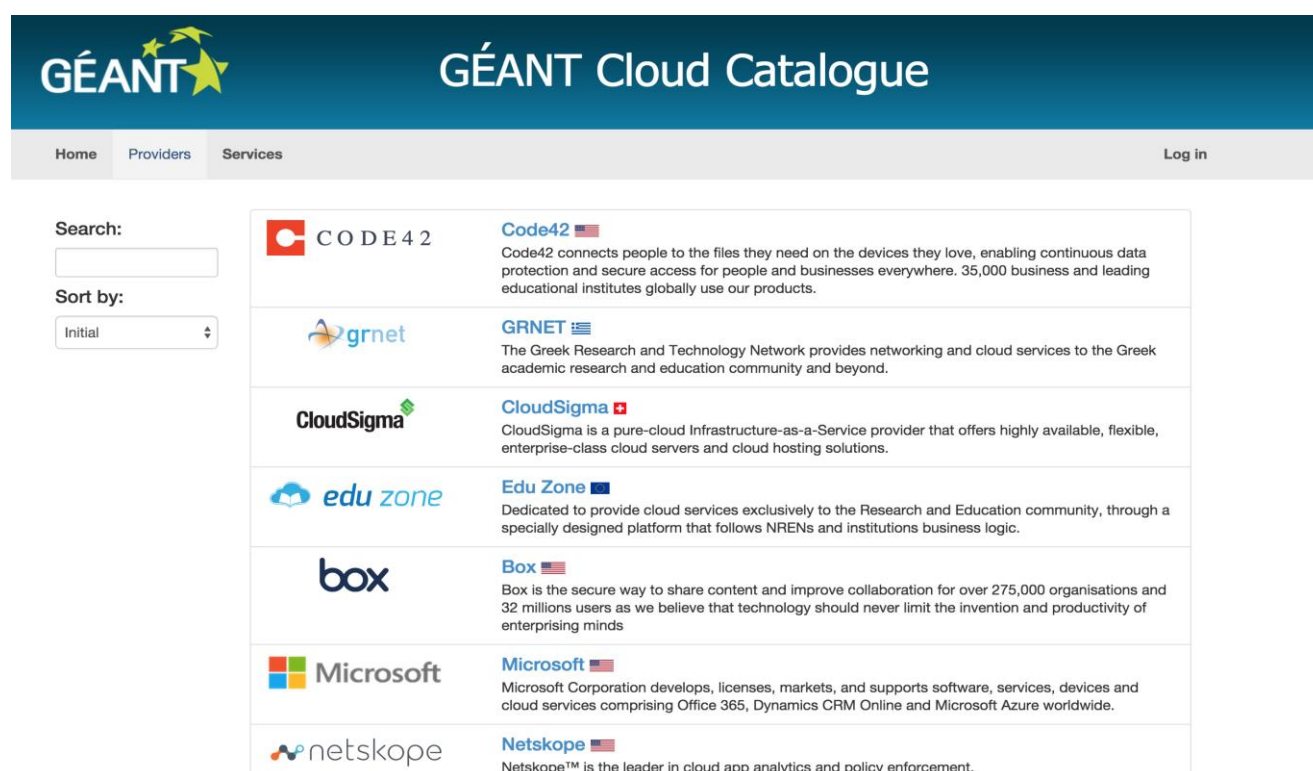
- Collaboration suites: Microsoft Office 365, EduZone EZ-Moodle, Google Apps.
- Infrastructure as a Service: Advania, CloudSigma, Eduzone EZ-Infrastructure, GRNET Okeanos, Google IaaS services, Microsoft Azure.
- File storage and sync: BOX, Crashplan, Shareplan.

- Other: EduZone EZ-AntiSPAM, Netskope Cloud Access Security Brokerage.















The community also responded positively to the cloud catalogue. There was a great willingness amongst the NRENs to continue the strong collaboration. This allowed SA7 to prepare and transition into the next stage of the work earlier than expected: the team invited the NRENs for a joint demand aggregation project, which was initially planned to commence after GN3plus. In this project the NRENs also want to benefit from economies of scale when acquiring services; by buying them together, using the cloud catalogue listings as selection criteria. The New Service Adoption project in Section 5 describes this transactional role and tender process in more detail.

Regarding the technical aspects of the Catalogue, it was built using Open Web frameworks and technologies [OPENWEB]. This has resulted in a responsive website, which dynamically scales to fit different screen sizes, web-browsers and devices. The site is implemented as a REST web service and a front-end web application [REST]. The REST web service provides all functionality of the cloud catalogue, with input and output represented as JSON documents [JSON]. This allows easy integration of the catalogue with other applications or services. The Catalogue is also integrated with eduGAIN [eduGAIN].

Cloud provider engagement is described in more detail in Section 5.3.



The screenshot shows the GÉANT Cloud Catalogue website. The header includes the GÉANT logo and the title "GÉANT Cloud Catalogue". Below the header is a navigation bar with "Home", "Providers", and "Services" links, and a "Log in" button. On the left side, there is a search bar and a "Sort by:" dropdown menu set to "Initial". The main content area displays a list of cloud providers, each with a logo, name, and a brief description:

 CODE42	Code42  Code42 connects people to the files they need on the devices they love, enabling continuous data protection and secure access for people and businesses everywhere. 35,000 business and leading educational institutes globally use our products.
 grnet	GRNET  The Greek Research and Technology Network provides networking and cloud services to the Greek academic research and education community and beyond.
 CloudSigma	CloudSigma  CloudSigma is a pure-cloud Infrastructure-as-a-Service provider that offers highly available, flexible, enterprise-class cloud servers and cloud hosting solutions.
 edu zone	Edu Zone  Dedicated to provide cloud services exclusively to the Research and Education community, through a specially designed platform that follows NRENs and institutions business logic.
 box	Box  Box is the secure way to share content and improve collaboration for over 275,000 organisations and 32 millions users as we believe that technology should never limit the invention and productivity of enterprising minds
 Microsoft	Microsoft  Microsoft Corporation develops, licenses, markets, and supports software, services, devices and cloud services comprising Office 365, Dynamics CRM Online and Microsoft Azure worldwide.
 netskope	Netskope  Netskope™ is the leader in cloud app analytics and policy enforcement.

Search:

Add Service

Sort by:

	<p>CloudSigma Public Cloud IaaS </p> <p>CloudSigma is a pure-cloud Infrastructure-as-a-Service provider that offers highly available, flexible, enterprise-class cloud servers and cloud hosting solutions. CloudSigma is one of the most customizable cloud providers on the market. Customers are able to provision CPU, RAM, Storage and bandwidth independently to allow the best combination of cloud resources without the limitation of fixed sizes. Any operating system and software can be installed with complete administrator/root control.</p> <p></p>
	<p>Okeanos </p> <p>The GRNET Cloud Service</p> <p></p>
	<p>EduZone EZ-Infrastructure </p> <p>Our service is custom designed with research & education users in mind. Rent anything you need: servers, networking devices, storage and data center space by using your eduGAIN account. Together with our partners we provide simple accessible IaaS platforms available with all major operating systems based on bare-metal or virtual technologies. All at your disposal - ready in few seconds.</p> <p></p>

Data Protection

Rating:

Requests for Data Access from 3rd Parties

Rating:

Notification

HIDDEN does not generally agree to liquidated damages. Service credits are, however, available in relation to unscheduled system downtime, based upon pre-established metrics.

Rating:

External Security Audit Certificate

Rating:

Concordance with National Privacy Act(s)

Rating:

Security of the Cloud Service

Rating:

Figures 4.2, 4.3 and 4.4: Screenshots of GÉANT Cloud Catalogue *Source:* [[CATALOGUE](#)]

Items covered in the catalogue:

1. IPR in Respect of Customer Data
2. Processing data
3. Ownership of data
4. Data protection
5. Requests for data access from third parties
6. Notification
7. Liquidated damages
8. External security audit certificate
9. Concordance with national privacy act(s)
10. Security of the cloud services
11. Managing security incidents
12. Data backup and restore
13. Compatibility
14. Portability
15. Supervision
16. Electronic data processing (EDP), audit
17. Network connectivity
18. Authentication and Authorisation Infrastructure (AAI)
19. User provisioning
20. Protection of minors as users
21. Subcontractors
22. Service Level Agreement
23. Quality review
24. Information about the performance of the service
25. Reporting / Metering / Sales Estimates
26. Billing
27. Governing law
28. Peering, Network Connectivity and Associated Costs

5 Collaboration Areas

The four elements in the GÉANT cloud foundation were applied in four collaboration areas for service types that are in high demand. These community needs and domains were identified in the first year of GN3plus, through community discussions and a cloud survey.

The four collaboration areas are as follows:

1. Collaboration software suites
2. File storage and sync
3. Infrastructure as a Service (IaaS)
4. Realtime communication

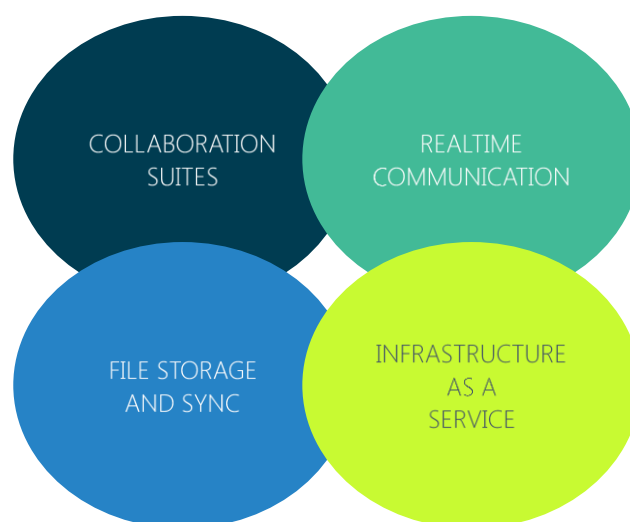


Figure 5.1: Collaboration areas of GÉANT cloud foundation

5.1 Hybrid Cloud Approach, Trusted Partners

In each of these collaboration areas, SA7 strove to maintain a good balance between activities, to help NRENS:

- With their own, in-house cloud offerings.
- Broker and distribute outsourced cloud offerings, offered by commercial (public cloud) providers.

Over the last two years, a number of high-profile cases around the world clearly demonstrated the risks involved in storing data outside of one's own organisation. The revelations by Edward Snowden and the Apple iCloud

hack affecting the accounts of Hollywood celebrities are good examples. The European Research and Education community has increasing concerns about privacy and security.

On the other hand, the Research and Education community clearly sees the benefits of the cloud distribution model, and is a forerunner in the clouds domain. The Research and Education community has been an early adopter of cloud services, as there is a distinct need to collaborate and share data across organisations and national borders (both within Europe and on a worldwide scale). Cloud services fit this model. The Research and Education community is an open, dynamic environment, with collaboration taking place between cross-organisational teams and across borders, while at the same time needing to safeguard sensitive information.

This combination of interest in cloud services and the need for trustworthy solutions led to a strong increase in the demand from R&E organisations, in asking their NRENs to delivery these safe cloud services. Multiple NRENs have been encouraged by their communities to deliver safe clouds; especially for secure online file storage and sharing services. This emphasises the unique role NRENs play as trusted advisors, brokers and providers. The NRENs collaborated on these safe clouds in SA7. The next paragraphs describe the efforts in more detail.

5.2 NREN In-House Cloud Service Collaboration

The SA7 team established a number of collaborations between groups of NRENs which offer in-house produced cloud services to their communities.

5.2.1 In-House, Collaboration Suites

The NRENs exchanged information on how to connect Microsoft Office 365 to the community identity management platforms to control user access. CESNET spearheaded a hybrid model where Microsoft Office 365 software was installed in CESNET's own data centre, keeping all data within their country.

5.2.2 In-House, File Storage and Sync

A considerable number of NRENs (ACONET, CARNet, CESNET, GARR, SURFnet, SWITCH) are currently offering or plan to offer secure file storage solutions to their communities, using the OwnCloud software. This application enriches a local storage system with 'Dropbox type of file sync and share capabilities'. SA7 and the GÉANT Association worked with the NRENs and the supplier to make this software package available with favourable conditions of use. [\[OWNCLOUD\]](#)

In addition, the NRENs exchanged knowledge on building and operating these file storage platforms, and discussed their technical and organisational aspects.

5.2.3 In-house, Infrastructure as a Service (IaaS)

The GRNET Okeanos IaaS service has been connected to eduGAIN and scaled up, from a national level (Greece) to the pan-European R&E community [[OKEANOS](#)]. This now opens Okeanos to users throughout Europe and allows them to run virtual machines at this facility.

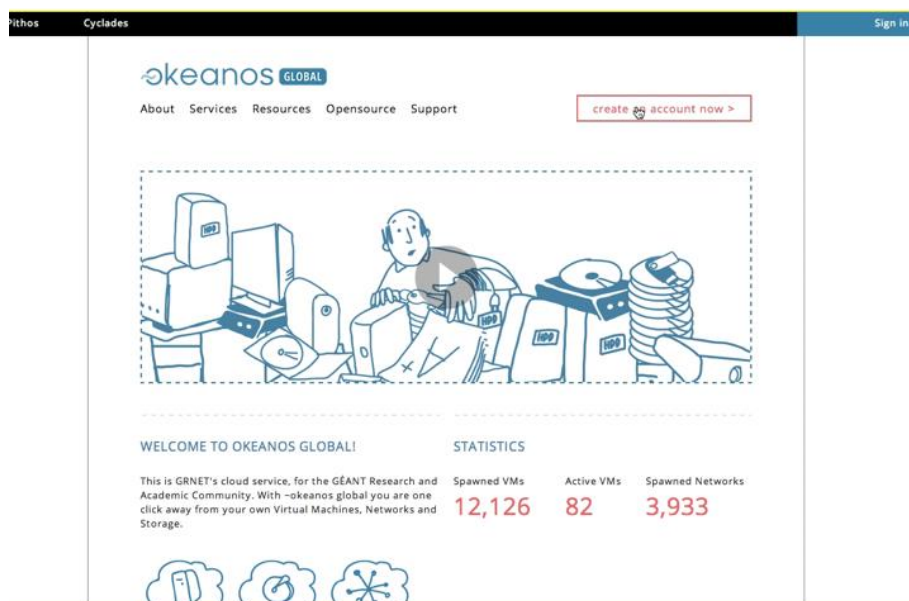


Figure 5.2: GRNET Okeanos IaaS service

More NRENs are exploring IaaS solutions (amongst them HEAnet, NORDUnet, SURFnet and SWITCH) and consider using the OpenStack software. These NRENs share expertise and look at joint delivery options through SA7.

5.2.4 In-house, Realtime Communication

Within realtime communications, the Rendez-Vous webconferencing service from RENATER, was made available in a pilot to the whole GÉANT community. Rendez-Vous is based on the open-source JITSI software [[JITSI](#)], which leverages the WebRTC protocol (an open standard) [[WEBRTC](#)].

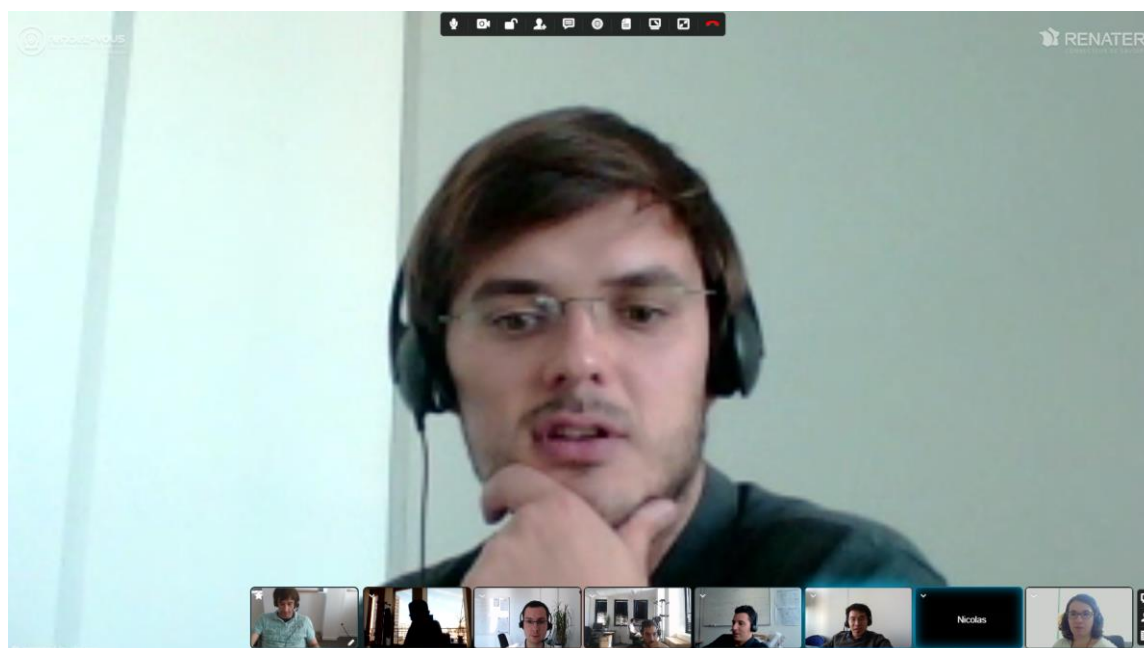


Figure 5.3: Example of RENATER's Rendez-Vous service

From October 2014 onwards, the pilot attracted 12000 conferences and 25000 users per month. Early 2015, the service was connected to eduGAIN.

Rendez-Vous, with a feature set comparable to products such as Adobe Connect and Cisco WebEx is an alternative to commercial offerings. Commercial providers in this space find it difficult to meet the community requirements in terms of interoperability and price. Rendez-Vous is an attractive alternative.

5.3 Commercial Cloud Suppliers Engagement and Connections

The NREN community jointly engaged with commercial cloud providers in the private sector, through SA7. Acting together, as European NRENs in GÉANT - as *one entity* - makes a big difference as it opens doors to the decision makers in the business and technical domain within the providers. Even for NRENs (individual countries) that were already active in the brokerage domain, this joint approach in GÉANT (on a pan-European level) brought a noticeable improvement of their individual efforts.

SA7 found the right 'recipe' for showing the delivery opportunity to suppliers and convincing providers to work with the team to adapt their services and delivery approach to meet the needs of the R&E community. At the start of the Activity it was essential for the SA7 team to agree on answers to the following questions:

- How to approach and talk to providers?
- What is the simple, clear message from SA7?
- What problems is SA7 solving for providers (provider viewpoint)?

The SA7 team learned ‘what makes providers tick’; to look at the R&E domain from a data and sales-driven business perspective and how to navigate the providers’ internal structures and decision-making processes. Interest was secure from a good set of providers, including global players, to work with the SA7 team. These suppliers:

- Acknowledge the delivery opportunity offered by GÉANT.
- Realise it is not feasible to discuss terms and conditions and establish technical connections with each of the 10 000 R&E institutions.
- Have a clear understanding of what suppliers needed to do, to meet GÉANT’s organisational, legal, financial and technical requirements.
- Have met or are working towards meeting the team’s needs; including joining our cloud catalogue, connecting to eduGAIN, peering with our network and responding to GÉANT’s IaaS tender.

See also: [\[SUPPLIERS\]](#).

5.4 New Service Adoption Project

Building on top of NRENs’ strong willingness to act together and the cloud foundation, the team added a new task in Year 2 of GN3plus, dedicated to cloud adoption. This Task made a start with establishing suitable and sustainable models for the delivery of cloud services through GÉANT and the NRENs, to the R&E institutions.

Through this cloud adoption task, SA7 took the first steps into a new phase:

- From a recommendation role through the cloud foundation (strategy, standards, requirements, catalogue)...
- ... into a *transactional* role, by zooming in on the service delivery supply chain:
 - Providing NRENs with the capabilities to distribute cloud services.
- Assisting institutions with the consumption of cloud services.

SA7 gathered, investigated and launched relevant cloud service resources:

- Procurement, legal and service delivery specialists from the community.
- As a group of sixteen NRENs, that confirmed they want to act together on service delivery:
 - AConet, ASNET-AM, BELNET, CARNet, CESNET, CYNET, FCCN, HEAnet, JISC, NIIF, NORDUnet, RedIRIS, RENAM, SURF, SWITCH and University of Malta.
 - Outside of Europe there is interest from AARNet (Australia) and REANNZ (New Zealand) in joining this initiative.

SA7 investigated suitable scenarios and systems, including the GÉANT World Service [GWS] and NRENs with Dynamic Purchasing Systems, for aggregating demand, procuring under public tendering rules and distributing services together. This also included appropriate organisational structures and technical systems to position GÉANT and the NRENs in a reseller-type-of-role, which involves service administration, provisioning and

metering requirements and allows services to be distributed and used with the required granularity: on a per-site, NREN, Institution, or user basis. GÉANT and the NRENs could use such facilities, to let R&E organisations consume the services and bill each of the R&E organisations according to its use of the service.

SA7 launched the collective tender for IaaS cloud services just before the end of GN3plus and will complete it during a future phase of work.

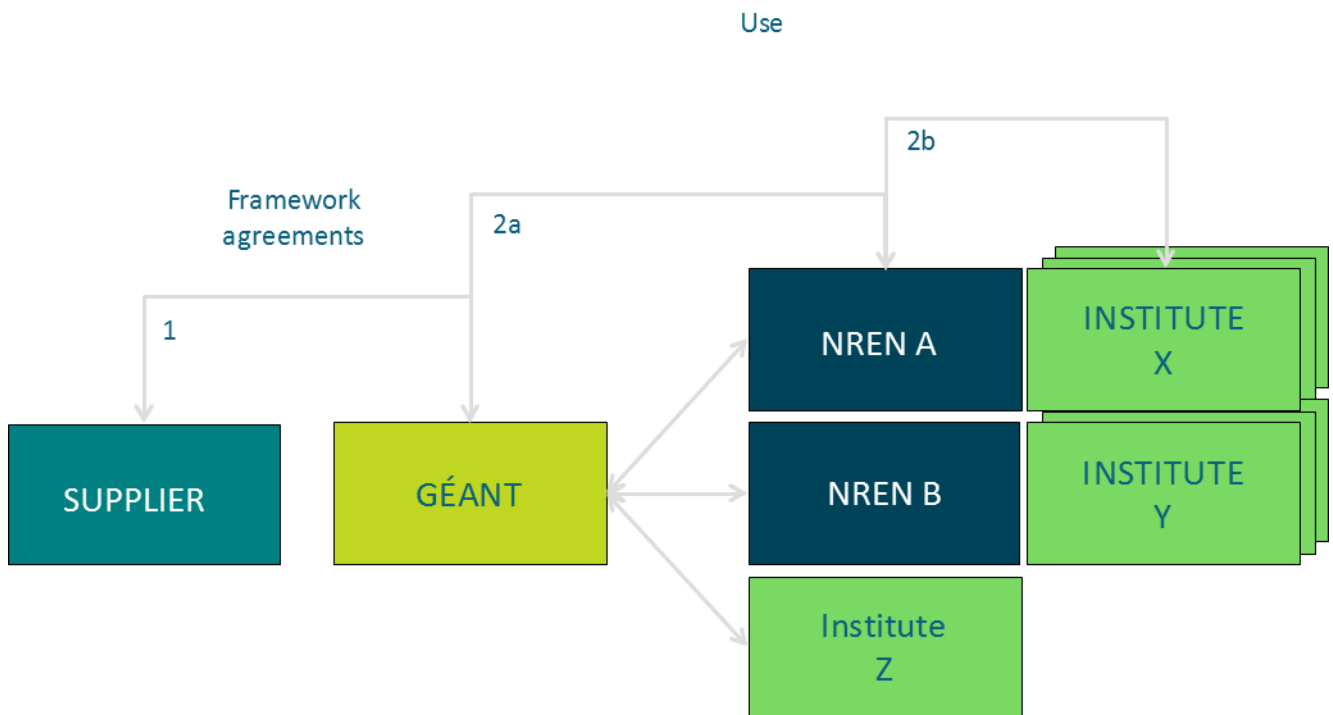


Figure 5.4: Demand aggregation and delivery structure

Besides interest from the R&E community there is a strong interest from providers (those in the GÉANT cloud catalogue) to work with the NRENs and GÉANT in this reseller role, as it makes service delivery much easier for them.

This work on the GÉANT and NREN supply chain channel, will allow the distribution of services:

- 'On the shelves' in the Cloud Catalogue.
- 'Off the shelves', into the hands of Research and Education users.

It will also enable and facilitate the community's use of online services, on a large scale, with the right conditions.

6 Communication

SA7 achieved an interactive information exchange between the NRENs and visibility of the GÉANT cloud activity within the R&E community, with providers and other stakeholders.

6.1 Website and Intranet

SA7 created a public website for the cloud activity and an intranet area on the GN3plus site [WEBSITE].

6.2 Online Meetings

SA7 organised weekly online webconferences:

- Team members used these meetings to discuss project progress.
- Everyone from within the R&E community was invited to have informal, low-key online chats about clouds and SA7. Those sessions were split in two parts: during the first part a specific topic was discussed, while the second part was open to whatever the attendees felt convenient to explore in detail. Attendance at such sessions was good and the dynamic and informal format enabled and facilitated a range of discussions.

6.3 Year 2 Events, Conferences and Presentations

No.	Type of Activities	Main Leader	Title	Name of Event	Date/Period	Place	Type of Audience	Size of Audience	Countries Addressed
25	Presentation	SA7	SA7 presentation and discussion session at TNC 2014	This session highlighted the work the GN3plus Cloud team is performing in the area of Cloud Services strategy and delivery. It was complemented by an overview of an NREN perspective (HEAnet) and a moderated discussion with Cloud Service providers and the audience. https://www.youtube.com/watch?v=vt6hXtZAYeI	May 2014	Dublin	Scientific Community (Higher Education, Research)	100plus	EU
26	Presentation	SA7	EC meets GÉANT session, presentation about clouds and mobile services	Presentation about the GÉANT clouds and mobile service activity for delegates from the EC	June 2014	Brussels	EC	20	EU

No.	Type of Activities	Main Leader	Title	Name of Event	Date/Period	Place	Type of Audience	Size of Audience	Countries Addressed
27	Presentation	SA7	SA7 Cloud strategy	Datacenter IaaS workshop 2014 - https://info.funet.fi/wiki/display/avoim/Datacenter+IaaS+workshop+2014	September 2014	Helsinki	Scientific Community (Higher Education, Research)	20	EU
28	Presentation	SA7	SA7 Service delivery	TF-MSP meeting – http://www.terena.org/activities/tf-msp/meetings/20140916/	September 2014	Budapest	GÉANT Community	25	EU
29	Presentation	SA7	SA7 services procurement	NORDUnet conference https://www.youtube.com/watch?v=qx8XTrF0dms	September 2014	Uppsala	GÉANT Community	10	EU
30	Workshop	SA7	Clouds workshop	GN3plus NA3T2 workshop http://www.terena.org/activities/development-support/Moldova2014/	September 2014	Chisinau	GÉANT Community	20	EU
31	Conference	SA7	Attended BOXworks conference and spoke with senior management	BOXworks 2014 http://boxworks2014.com	September 2014	San Francisco	External	5	USA

No.	Type of Activities	Main Leader	Title	Name of Event	Date/Period	Place	Type of Audience	Size of Audience	Countries Addressed
32	Conference	SA7	EGI and GÉANT symposium on Federated community cloud services for research	On the 25th and 26th of September, EGI and SA7 hosted a joint symposium on federated community clouds for research, as part of the EGI Autumn Conference. The conference was well attended with over 150 participants including representatives from NRENs and a large number of NGIs, who were able to find out more about what GÉANT and EGI are working on in this fast moving field. Besides presentations from EGI and GÉANT, there were many presentations from NGIs and NRENs.	September 2014	Amsterdam	Scientific Community (Higher Education, Research)	150	EU
33	Presentation	SA7	STF meeting	Presentation about clouds in STF meeting	November 10	Utrecht	GÉANT community	25	EU
34	Presentation	SA7	IUAC	Presentation about clouds in IUAC meeting	December 2	Geneva	GÉANT community	20	EU

No.	Type of Activities	Main Leader	Title	Name of Event	Date/Period	Place	Type of Audience	Size of Audience	Countries Addressed
35	Workshop	SA7	CERN	Discussed clouds with CERN representatives	December 3	Geneva	Scientific Community (Higher Education, Research)	8	EU
36	Presentation	SA7	Earth Science	Presentation about clouds in Earth sciences community meeting	January 23	Amsterdam	Scientific Community (Higher Education, Research)	40	EU
37	Workshop	SA7	Google	Discussed clouds with Google and NREN and University representatives	January 26	London	GÉANT community, commercial representatives	25	EU
38	Workshop	SA7	Business development and provider engagement workshop	Business development and provider engagement workshop, together with GÉANT training team	January 27	London	GÉANT community	10	EU
39	Workshop	SA7	Microsoft	Discussed clouds with Microsoft and NREN representatives	February 4 and 5	Redmond	GÉANT community, commercial representatives	15	Global

No.	Type of Activities	Main Leader	Title	Name of Event	Date/Period	Place	Type of Audience	Size of Audience	Countries Addressed
40	Workshop	SA7	Amazon	Discussed clouds with Amazon and NREN representatives	February 6	Seattle	GÉANT community, commercial representatives	15	Global
41	Presentation and Workshop	SA7	GN3plus Symposium	Three hour clouds session at GN3plus symposium	February 24	Athens	GÉANT community	75	EU
42	Presentation	SA7	ELIXIR	Presentation about clouds at ELIXIR workshop / meeting	March 12	Amsterdam	Scientific Community (Higher Education, Research)	35	EU
43	Presentation	SA7	TF-CPR	Presentation and discussion about clouds at TF-CPR meeting	March 18	Amsterdam	GÉANT community	20	EU
44	Presentation	SA7	TF-MSP	Presentation and discussion about clouds at TF-MSP meeting	March 19	Amsterdam	GÉANT community	15	EU
45	Presentation	SA7	STF	Presentation about clouds at STF meeting	March 25	Berlin (remote participation)	GÉANT community	20	EU

6.4 Case Descriptions

SA7 gathered a set of case descriptions, from NRENs offering cloud services and their interactions with institutions. These stories are included as an addendum to the Cloud Strategy document.

Story #1: EduStorage at HEAnet

Story #2: Okeanos at GRNET

Story #3: u:cloud at ACONET

Story #4: refining Cloud strategy at SURFnet

Story #5: Cloud services in NORDUnet

Story #6: Cloud services at SWITCH

Story #7: Cloud services at PSNC and user interaction.

Story #8: Cloud services at CESNET

Story #9: Google Apps for Education at the University of Groningen

6.5 Skill Development

SA7 organised a workshop on service delivery and business development. This session helped to:

- Support community improvement of knowledge in areas such as value propositions, provider interactions, portfolio management, procurement and service distribution.
- Establish a common language and approach as NRENs.



Figure 6.1: SA7 workshop

6.6 EC

The SA7 team interacted with the EC on clouds and our input was well received.

- Participated in meetings of the EC Clouds Select Industry Group on Service Level Agreements.
- Provided input for EC report: “Analysis of Cloud Best Practices and Pilots for the Public Sector” (November 2013) [CLOUDBP].
- Participated in a public consultation for the H2020 Work Programme 2016-17 on clouds (Q4 2014)
 - Written input, and Presentation at EC workshop
 - EC report reflected our recommendations:

“The European education and research community is a well-suited vertical to act as an early adopter deploying tools for managing digital content for online/offline learning with collaboration between educational institutions. (...) There was unanimous support, during the post-consultation workshop, for testing cloud applications and services beyond the capabilities of current commercial cloud providers. Existing platforms, including those from GÉANT, Bonfire/FIRE, the FI-PPP and GRID 5000 in France, focus on different aspects of cloud computing experiments and with appropriate extensions they could support future experimentation requirements.”

6.7 Other e-Infrastructures and Stakeholders

This activity included interaction with several other e-infrastructures and stakeholders.

On the 25 and 26 September 2014, EGI and GÉANT hosted a joint symposium on federated community clouds for research. The conference was well attended with over 150 participants, including representatives from NRENs and a large number of NGIs, who were able to find out more about what GÉANT and EGI are working on in this fast-moving field. Besides presentations from EGI and GÉANT, there were many presentations from NGIs and NRENs. The symposium gave valuable insights in current activities and potential areas where follow up collaborations could take place, such as:

- Security
- AAI
- Standards and interoperability
- Policies to serve ESFRIs
- User requirements and user support

The SA7 team discussed clouds with CERN, including community cloud services (such as OwnCloud, and OpenStack) [OWNCLOUD] [OPENSTACK].

SA7 exchanged information with the Global CEO forum Global Service Delivery group. The GSD group now uses the SA7 cloud requirements document for their provider engagements. The two groups kept each other up-to-date on their approaches and plans.

SA7 presented and discussed clouds at GÉANT conferences for the life sciences and Earth sciences.

7 Lessons Learned and the Need for a GÉANT Service Delivery Gateway

Despite the optimism about how cloud services empower end-users and organisations, the fact remains that cloud adoption in Europe is slower than expected, and take up is less than in other continents.

National legislation and regulations, combined with the economic situation and concerns about security and privacy, lead to obstacles that can seriously hamper the take-up of cloud services.

The SA7 team is therefore grateful, to be given the opportunity to work with GÉANT partners to contribute to reducing those barriers and to help drive adoption of cloud services in our R&E community, with the right conditions of use.

7.1 Lessons Learned During GN3plus

The challenges in this area also provided the team with a number of valuable lessons to apply to future actions.

Lesson 1: Scale is significant

Working together as NRENs within GÉANT on clouds, opens doors to suppliers and stakeholders. The impact of such economies of scale are significant. Our joint service delivery activity contributes to a connected Europe and a single digital market. The collective approach works.

Lesson 2: Expertise is scarce

Tackling the challenges for cloud service delivery requires technical expertise and business development, procurement experts and legal specialists. These non-technical roles are scarce within the NREN community. A good team reflecting these roles and with the required skills has been brought together in SA7.

Lesson 3: There is no golden path

Within the large GÉANT community, there are many different needs, demands and requirements. Cloud services provide the community with the choice they desire. There is not a one size fits all solution to use cloud services, there are multiple paths and approaches. SA7 tried to accommodate this diversity: by working on in-house and

outsourced cloud solutions, different service types and a mix of small and large providers, from within Europe and abroad.

Lesson 4: Build on what is in place

Using cloud services should not require a leap of faith and be a logical progression from IT structures already in place. For the element of trust: NRENs are the trusted advisors, brokers and providers for the Research and Education institutions. NRENs have been delivering online services for many years and clouds are nothing more than a new model to distribute those services. R&E organisations can control services delivered through their NRENs. The eduGAIN identity management ecosystem developed within GÉANT and GÉANT network itself are assets to connect the clouds to the community. Combined with aggregated provider engagement, the cloud catalogue and joint procurements, more affordable and predictable cost models and conditions of use that meet the needs of our community, can be achieved.

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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