



GENERALISED ARCHITECTURE FOR DYNAMIC INFRASTRUCTURE SERVICES

Large Scale Integrated Project

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Abstract

This document is the first standardisation activity report of the GEYSERS project, containing the status regarding GEYSERS' standardisation efforts. This document describes the standardisation activities performed during Y2 (2011) and Y3 (2012, up to M32).

Dissemination Level

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1 Executive Summary

The standardisation Task (T6.4) in GEYSERS establishes and agrees upon a general strategy for the use of the expected project results in the standardisation bodies. This first standardisation activity report will be consolidated into the final version (Deliverable D6.5) which will occur towards the end of the project. The GEYSERS impact action plan established in June 2012 integrates a special action for standardisation activity reinforcement. This document presents the guidelines as well as the current actions that constitute the core of the GEYSERS standardisation activity.

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2 Introduction

Task T6.4: “GEYSERS standardisation activities” is led by Alcatel-Lucent Italy (ALU-I). In accordance with the current DoW, this Task started in M14 and will end in M36. The objectives are defined as:

- Analyse and monitor existing and emerging standards that are relevant to GEYSERS.
- Actively explore, and if relevant participate, in related Tele Management Forum (TMF), Open Grid Forum (OGF) and IETF activities where partners have already active contributions.
- Propose extensions or enhancements of established standards to support GEYSERS (e.g., PCE, GMPLS).
- Draft and submit new standards required to support GEYSERS.
- Standardisation strategy elaboration and continuous update.
- Promotion of the GEYSERS architecture and virtualisation solutions at the relevant standardisation & regulation bodies.

This document is organised in two main sections: the first section identifies the standardisation strategy that GEYSERS is adopting to identify the main outcome of the project. The second section is devoted to the standardisation activities performed by individual partners during 2011 and 2012 (up to M32).

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3 Standardisation strategy

The GEYSERS scientific standardisation strategy operates according to the plan described in deliverable D6.2 Standardisation Activity Plans and Standardisation Bodies identified. GEYSERS focuses on participating and influencing the standardisation bodies since these are recognised as being the most important single measure to achieve interoperability. The objective of this deliverable D6.4 is to perform the last step of the GEYSERS project; namely, to launch the official standardisation process for the results achieved in WP1 to WP5. In order to successfully achieve this objective, two steps were identified:

- Step1: Identification of the standardisation bodies. The appropriate standardisation committees were listed, analysed, evaluated and prepared for cooperation with GEYSERS.
- Step2: Provision of the appropriate documents which can be launched as extensions to existing standards or as new standards (Internet Draft production).

The implementation of the standardisation strategy is organised as follows:

- Create awareness for GEYSERS: the first phase of producing deliverable D6.4 was devoted to preparing the standardisation community to consider the innovative concepts and results of the GEYSERS project in their work.
- Transform the results of GEYSERS into standards: an effort in processing the results of WP1 to WP5 into drafts of standardisation documents, which could be provided to the appropriate standardisation groups. This task is closely linked to the activities of Task T6.3: “Dissemination”.

The Table 1 lists the standardisation bodies that have been identified as the most relevant and in which various GEYSERS partners already have active involvement.

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Organisation	Working Groups	Relevance for GEYSERS	GEYSERS representation
IETF - Internet Engineering Task Force	PCE Working Group	High	NXW & TID
	Clouds Bar BoF	High	NXW & TID
	VNRG - Virtual Networks Research Group	High	NXW & TID
	CCAMP Working Group	Low	NXW & TID
	MPLS Working Group	Low	NXW & TID
TMF – TeleManagement Forum	TMF Interface Programme	Medium	UvA, ALU-I
DMTF – Distributed Management Task Force	Cloud Management Working Group	High	UvA
OGF – Open Grid Forum	NSI-WG - Network Service Interface Working Group	Medium	UvA, i2CAT
	NML-WG - Network Markup Language Working Group	Medium	UvA, i2CAT
	ISOD-RG - Infrastructure Services On-Demand Provisioning Research Group	High	UvA, PSNC, i2CAT
	OCCI – Open Cloud Computing Interface	High	ALU-I
NIST – National Institute of Standards and Technologies	NIST Cloud Computing Standards Roadmap Working Group	High	UvA
International Communities	Relevance for GEYSERS	GEYSERS representation	
VXDL Forum	High	Lyatiss-INRIA	

Table 3-1 – Appropriate standardisation bodies for GEYSERS

The following sections introduce the details about each standardisation committee identified as being relevant for GEYSERS.

3.1 IETF - Internet Engineering Task Force

The IETF is a forum where network operators, hardware and software implementers, and researchers share their views to ensure that future protocols, standards and products are even better and interoperate. It is the forum where the basic technical standards for Internet protocols (i.e IP at very large) are set and maintained.

3.1.1 PCE Working Group

The Path Computation Element (PCE) Working Group [PCE-WG] is chartered to specify a Path Computation Element (PCE) based architecture for the computation of paths for MPLS and GMPLS Point-to-Point and Point-to Multi-point Traffic Engineering Label Switch Paths (LSPs).

3.1.2 Clouds Bar BoF and related activity at IETF

The Cloud Bar BoF took place at IETF78 (August 2010) and has produced an Internet Draft, "IETF Cloud Reference Framework", that proposes a framework for developing new standards to consistently support Cloud services with the network-, transport- and messaging- services which are in the scope of IETF standardisation. The proposed Cloud Reference Model defines a number of horizontal layers: Application/ Service Layer, Resources Control Layer, Resources Abstraction and Virtualisation Layer, Physical Resources Layer; and vertical Cloud Management Layer. The current draft also suggests the definition of an Inter-Cloud Framework that should address the following requirements:

- Provide a mechanism for resource search and discovery.
- Provide a mechanism to authenticate participating entities.
- Provide a mechanism for requesting, controlling, and releasing resources between two Clouds.
- Provide a secure transport channel between the interconnecting entities.
- Provide end-to-end isolation to support multi-tenancy.
- Provide a mechanisms for monitoring, QoS, assuring, and troubleshooting across the interconnection.

Possible inter-Cloud Interfaces may include provisioning, signalling, control, monitoring, management, transport, security, naming and addressing.

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3.1.3 VNRG - Virtual Networks Research Group

The Virtual Networks Research Group [VNRG] is considered as one of the main interests of the GEYSERS project. Liaison has been established and project representatives made contributions to the RG discussion at the IETF77 and IETF78 meetings.

3.1.4 CCAMP Working Group

The Common Control and Management Plane (CCAMP) Working Group is chartered to define an architecture, composed of a common control plane and a separate measurement plane, suitable for managing the physical path and core tunnelling technologies of Internet and Telecom service providers. e.g. O-O and O-E-O optical switches, TDM Switches, Ethernet Switches, ATM and Frame Relay switches, IP encapsulation tunnelling technologies, and MPLS in cooperation with the MPLS WG. It should be noted that, in this context, measurement refers to the acquisition and distribution of attributes relevant to the setting up of tunnels and paths.

3.1.5 MPLS Working Group

The Multi-Protocol Label Switching (MPLS) Working Group is responsible for standardising a base technology for using label switching and for the implementation of label-switched paths over various packet based link-level technologies, such as Packet-over-SONET, Frame Relay, ATM, and LAN technologies (e.g. all forms of Ethernet, Token Ring, etc.). This includes procedures and protocols for the distribution of labels between routers, and encapsulation.

3.2 TMF - TeleManagement Forum

The TeleManagement Forum [TMF] is the world's leading industry association focused on enabling best-in-class IT for service providers in the communications, media, defence and Cloud service markets. The TMF provides business-critical industry standards and expertise to enable the creation, delivery and monetisation of digital services. The TMF brings together the world's largest communication and technology companies, providing an innovative, industry-leading approach to best practices and standards, along with a wide range of support services including benchmarking, training and certification. Many TMF developments are proposed to the ITU-T standardisation activity in the area of telecommunication networks management, known as M-seria, and Next Generation Network (NGN), known as Y-seria.

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3.2.1 TMF Interface Programme

The TMF Integration Programme (TIP) has the goal of addressing and mitigating the integration overhead problem by creating a set of standardised interfaces that enable integration among systems. Most successful standardised interfaces are MTOSI (which covers OS-OS interface and provides XML solution) and MTNM (which covers more specific NMS-EMS interface and provides CORBA/IDL solution). MTOSI and MTNM are network level interfaces, i.e. their focus is the end-to-end management of connections, both TDM (SDH/SONET, OTN) and packet connectionless (Ethernet) technologies, including OAM, Protection and Control Plane driven restoration. ALU-I has been actively contributing to these standardisation efforts for a decade, and their next main commitment is the specification of the MPLS-TP network management model, the transport profile of MPLS technology which supports the capabilities and functionalities of a packet transport network as defined by ITU-T.

3.2.2 TMF Service Delivery Framework

The TMF Service Delivery Framework (SDF) [TMF-SDF] is a part of their New Generation Operations Systems and Software (NGOSS) solutions framework. The main motivation behind developing SDF is achieving automation of the whole service delivery and operation process, in particular:

- End-to-end service management in a multi-service provider's environment.
- End-to-end service management in a composite, hosted and/or syndicated service environment.
- Management functions to support a highly distributed service environment; for example unified federated security, user profile management, charging, etc.
- Any other scenario that pertains to a given phase of the service lifecycle challenges, such as onboarding, provisioning or service creation.

SDF services lifecycle corresponds to the general services lifecycle management model that includes the abovementioned service lifecycle stages. It includes the following main stages:

- Infrastructure creation request sent to VIO or VIP that may include both required resources and network infrastructure to support distributed target user groups and/or consuming applications.
- Infrastructure planning/design and advance reservation.
- Infrastructure deployment including services synchronisation and initiation.
- Operation stage.
- Infrastructure decommissioning.

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The SDF combines in one provisioning workflow all processes that are run by different supporting systems and executed by different actors, however it still requires many manual engineer-oriented operations, especially at the design/planning stages.

GEYSERS adopted SDF for the infrastructure services provisioning and extended it with additional stages and supporting systems to allow fully automatic services provisioning. It is intended to submit the GEYSERS use case of the infrastructure services virtualisation and dynamic provisioning to the TMF SDF task force.

3.3 DMTF - Distributed Management Task Force

DMTF provides standard management tools supported by numerous hardware, software and service vendors. Standards become even more crucial with the increasing pressure to ensure that technology investments remain viable for years to come. Standards allow forward-thinking CIOs and IT managers to select the products that best suit their needs today – regardless of vendor – while helping to ensure that no proprietary constraints arise when new systems are put in place in the future.

3.3.1 Cloud Management Working Group

The Cloud Management Working Group is developing a set of standards to improve Cloud management interoperability between service providers and their consumers and developers. Technologies such as Cloud computing and virtualisation are rapidly being adopted by enterprise IT managers to better deliver services to their customers, lower IT costs and improve operational efficiencies. Using the recommendations developed by its Open Cloud Standards Incubator, DMTF's Cloud efforts are focused on standardising interactions between Cloud environments. With that purpose, specifications are being developed that deliver architectural semantics and implementation details to achieve interoperable Cloud management between service providers and their consumers and developers. This work is being addressed in the Cloud Management Work Group (CMWG) and the Cloud Auditing Data Federation (CADF) Work Group.

3.4 OGF – Open Grid Forum

3.4.1 NSI-WG - Network Service Interface Working Group

The NSI Working Group of the Open Grid Forum [NSI-WG] has been set up to develop the Network Services Interface (NSI) and related specifications. The scope of the NSI WG includes developing the Service Layer or Service Plane interface to network services provisioned at the transport network layer, in particular, the interface between Grid middleware and the network infrastructure as well as the interface between network domains in order to provide interoperability in a heterogeneous multi-domain environment.

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3.4.2 NML-WG - Network Markup Language Working Group

The OGF NML WG is focused on the development of the common data model and schema for network topology description to facilitate interoperability between different network resource provisioning and management systems. The schema should provide an abstraction layer for networks, specifically hybrid networks. Such a schema can be used to create inter-domain network graphs at various abstraction levels, to provide an information model for service discovery, and to facilitate optical light path provisioning.

3.4.3 ISOD-RG - Infrastructure Services On-Demand Provisioning Research Group

The main purpose of the ISOD RG is to develop an informational architecture framework that outlines the necessary components for on-demand infrastructure services provisioning (in particular, generic IaaS Cloud provisioning model) that can support new emerging business and operational models for virtualised infrastructure providers. The expected results should create a basis for developing heterogeneous services inter-operation and the creation of new interoperable and composable services.

It is intended that the ISOD RG will provide use cases and recommendations for development of upper layer service frameworks for a number of currently running related initiatives at OGF, such as NSI WG, NML WG, OCCI WG, CDMI at SNIA, and will review standardisation work done by the ITU-T and TMF for possible adoption by the OGF user community.

The ISOD RG investigates the following items:

- Infrastructure services definition.
- Infrastructure services virtualisation issues.
- Existing on-demand infrastructure resource provisioning systems and frameworks, including Cloud Infrastructure as a Service (IaaS).
- Basic use cases and requirements to infrastructure resources virtualisation and provisioning systems, including service delivery frameworks and services lifecycle management.
- Atomic services required to build an on-demand infrastructure services framework.
- Security issues, e.g. integration between virtual security infrastructure and provider platform, security context and session management.

Currently, the ISOD-RG focuses its work on researching existing practices and models in Cloud infrastructure services provisioning, intending to provide recommendations for the major standardisation directions for building interoperable heterogeneous Cloud based virtualised infrastructure services.

GEYSERS contributes to the current ISOD-RG document on Infrastructure services provisioning best practices. Future contributions may include Infrastructure services description languages overview and best practices

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that should leverage the GEYSERS LICL Information Modelling Framework (IMF) and provide recommendations for further IMF development.

3.4.4 OCCI – Open Cloud Computing Interface

The Open Cloud Computing Interface comprises a set of open community-lead specifications delivered through the Open Grid Forum. OCCI is a protocol and API for all kinds of management tasks. OCCI was originally initiated to create a remote management API for IaaS model based services, allowing for the development of interoperable tools for common tasks including deployment, autonomic scaling and monitoring. It has since evolved into a flexible API with a strong focus on integration, portability, interoperability and innovation while still offering a high degree of extensibility. The current release of the Open Cloud Computing Interface is suitable to serve many other models in addition to IaaS, including e.g. PaaS and SaaS.

The reasons driving the development of OCCI are:

- Interoperability – Allow for different Cloud providers to work together without data schema/format translation, façade/proxying between APIs and understanding and/or dependency on multiple APIs.
- Portability – No technical/vendor lock-in, and enabling services to move between providers, allows clients to easily switch between them with minimal technical cost, and enables and fosters competition.
- Integration – Implementations of the specification can be easily integrated with existing middleware, 3rd-party software and other applications.
- Innovation – Driving modern technologies.

3.5 NIST - National Institute of Standards and Technologies

NIST, an agency of the U.S. Department of Commerce, was founded in 1901 as the nation's first federal physical science research laboratory. Over the years, the scientists and technical staff at NIST have made solid contributions to image processing, DNA diagnostic "chips," smoke detectors, and automated error-correcting software for machine tools. Just a few of the other areas in which NIST has had major impact include atomic clocks, X-ray standards for mammography, scanning tunnelling microscopy, pollution-control technology, and high-speed dental drills.

3.5.1 NIST Cloud Computing Standards Roadmap Working Group

The NIST Cloud Computing Standards Roadmap Working Group is producing Cloud computing documents that include standards, conceptual models, reference architectures and standards roadmaps to facilitate

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communication, data exchange, and security for Cloud computing and its application. Still other standards are emerging to focus on technologies that support Cloud computing, such as virtualisation. The NIST Cloud Computing Standards Roadmap Working Group is leveraging this existing, publicly available work, plus the work of the other NIST working groups, to develop a NIST Cloud Computing Standards Roadmap that can be incorporated into the NIST USG Cloud Computing Technology Roadmap.

NIST's long-term goal is to provide leadership and guidance around the Cloud computing paradigm to catalyse its use within industry and government. NIST aims to shorten the adoption cycle, which will enable near-term cost savings and increased ability to quickly create and deploy safe and secure enterprise solutions. NIST aims to foster Cloud computing practices that support interoperability, portability, and security requirements that are appropriate and achievable for important usage scenarios. The NIST area of focus is technology, and specifically, interoperability, portability, and security requirements, standards, and guidance. The intent is to use the standards strategy to prioritise NIST tactical projects, which support USG agencies in the secure and effective adoption of the Cloud computing model to support their missions. The expectation is that the set of priorities is useful more broadly by industry, SDOs, Cloud adopters, and policy makers.

3.6 VXDL forum

The VXDL forum aims at promoting and extending VXDL as the language for modelling virtual infrastructures and dynamic Cloud infrastructures as they are delivered to Cloud customers. The ultimate goal of the VXDL Forum is to establish VXDL as the “infrastructure programming language” which enables any user or software to create and manipulate an abstract network of resources. This would represent the instantiation of an on-demand interconnection of virtual resources in a multi-Cloud/Internet environment.

The language was initially proposed and defined by INRIA and adopted by several research communities worldwide. VXDL is gaining recognition in both academy and industry as a modelling and specification language and appears to be highly needed by the Cloud shareholders (users and providers).

The concept of virtual infrastructures combining computing, storage and networking resources in an abstract network of virtual resources, is one of the core concepts of GEYSERS. For example, this is the key concept of the LICL. VXDL is expressing the external view of such concept. VXDL has been derived to produce the internal information model IMF.

Virtual infrastructures are complex dynamic objects that have a lifetime (composition, reservation, activation, migration, evolution, pause, store, and reactivate operations). For example, users can define the virtual infrastructure topology and its capacity according to the applications’ requirements which they plan to run over it. A Cloud provider is then asked to instantiate it. To facilitate the specification and the manipulation of these logical objects, VXDL proposes a simple open language. VXDL can be envisioned as the programming language for Clouds IaaS and NaaS and an abstract low level interface for SaaS and PaaS. The goal is to establish the baseline of a VXDL generator for PaaS and SaaS services providers as well as VXDL parser implementations for IaaS service providers.

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GEYSERS, through contributions by Lyatiss, is participating in the following extensions of the VXDL language:

- The elastic service specification (in close collaboration with SAIL).
- The optical network virtualisation specification (specific to GEYSERS).
- The virtual infrastructure energy management specification (specific to GEYSERS).

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4 Standardisation activities

4.1 WP6 report on standardisation activities in 2011

During 2011, the following standardisation activities were performed:

Title	Title of Organisation or event	Status	Date of publication	GEYSERS author(s)
GEYSERS at the BoF “Provisioning infrastructure services on-demand: beyond Grids and Clouds”	TNC 2011	Completed	May 16, 2011	Y. Demchenko (UvA) and B. Belter (PSNC)
Architecture for Service Provisioning with Cross Stratum Optimisation	IETF 82	Completed	October 20, 2011	L. M. Contreras, A. Tovar (TID) G. Landi, N Ciulli (NXW)
Path Computation Requirements for Cross-Stratum-Optimisation	IETF 82	Completed	October 20, 2011	A. Tovar, L. M. Contreras (TID) G. Landi, N Ciulli (NXW)

Table 4-1 - WP6 report on standardisation activities in 2011

4.1.1 GEYSERS at the BoF “Provisioning infrastructure services on-demand: beyond Grids and Clouds” at the TNC2011 conference

Modern e-Science applications and high-technology industry regularly deal with large volumes of data that must be stored, processed and visualised. This requires dedicated high-speed network infrastructures, which can be provisioned on-demand to support all potential application scenarios.

Most Grid/Cloud usage scenarios for collaboration can benefit from combined network and IT resources provisioning. This notion of provisioning an infrastructure on-demand not only improves performance, but also addresses such issues as application-centric manageability, consistency of security services, and energy efficiency (which is emerging as a forefront issue). The infrastructure on-demand provisioning model requires that a number of services and resource management systems interoperate at different stages within the whole provisioning process. However, in current practice, different systems and provisioning stages are not connected into a single unified workflow, which impedes the definition of a whole provisioning model. This results in a set of inconsistent, disjoint services that then require a significant amount of human intervention to manually integrate them into a single cohesive service.

The problem of better supporting collaborative groups of people and wider user communities at all layers of networking and applications infrastructure remains unsolved. The BoF will try to look at future developments and future technologies to solve this problem. This BoF will provide a venue to discuss a wide spectrum of research and technology problems in provisioning infrastructure services on-demand, existing frameworks to support on-demand infrastructure services provisioning, and new emerging business models for infrastructure virtualisation, such as Cloud Infrastructure as a Service (IaaS). The BoF will host presentations from EU projects and activities such as GEANT3, GEYSERS, NOVI, OGF ISOD RG and facilitate information and experience dissemination and exchange with the TERENA community.

4.1.1.1 Workshop agenda

Session A (9:00-10:30) - Projects presentation

1. Introduction and BoF overview (15 min)
2. GEYSERS Architecture and implementation (25 min)
 - B. Belter (PSNC, GEYSERS WP5 leader)
3. GEANT3 developments in on-demand service provisioning and virtualisation
 - 3.1. GEMBUS as a Composable Services provisioning platform (25 min)
 - D. Lopes (RedIRIS, GN3-JRA3-T3 leader), R. Hedberg (UMU.SE)
 - 3.2. GN3 Multi-domain Management (25 min)
 - Afrodite Sevasti (GRNET, GN3-JR2 leader)

Session B (11:00-12:30)

4. Architectural Framework for Cloud Infrastructure as a Service (IaaS) development by UvA
 - (including Security paradigms in Clouds) Y. Demchenko, UvA
5. Standardisation - from Grid to Clouds and general ISOD provisioning
 - (including OGF ISOD-RG overview) Y. Demchenko, UvA
6. Discussion - 11:45 – 12:30

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4.1.1.2 GEYSERS @BoF

The GEYSERS project was represented at the workshop with two persons: Yuri Demchenko (UvA) – the chair of the meeting, and Bartosz Belter (PSNC) – a speaker. Bartosz Belter presented the architectural approach taken in GEYSERS and explained how it fits into the NREN community. Although the BoF was considered as purely technical, a discussion on business impacts of Clouds on NRENs and related communities was raised several times. The GEYSERS presentation stimulated a discussion on the role of NRENs in the Cloud-related research activities.

4.1.1.3 General ISOD BoF outcome

One important outcome of the meeting was establishing a new mailing list nren-clouds@terena.org – where post-meeting discussions are being held. In the post BoF discussion it appeared that TERENA will consider this mailing list as a main forum to discuss Cloud-related issues among NRENs. The official BoF website is available at: <https://tnc2011.terena.org/core/event/6>

4.1.2 IETF 82: Architecture for Service Provisioning with Cross Stratum Optimisation (TID, NXW)

A functional architecture able to provide dynamic and on-demand service provisioning with cross stratum optimisation was presented. The proposed architecture can handle the seamless provisioning of both IT and network resources in a dynamic manner to satisfy the application demands [CSO-ARCH]

4.1.3 IETF 82: Path Computation Requirements for Cross Stratum Optimisation (TID, NXW)

The cross stratum optimisation approach aims for providing a jointly optimised provision of both IT and network resources according to the application demands. In order to do that, the path computation capabilities in the network, which are in charge of finding the optimal connectivity resources, should take into account a new set of requirements [CSO-PCE]

4.1.4 VXDL activities

Different activities and collaborations around VXDL have taken place during this year in the context of the VXDL Forum. The language has especially been presented at ETSI and OGF 33, and has been further extended for GEYSERS as well as for the EU FP7 SAIL project.

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4.1.4.1 VXDL extensions within GEYSERS

Within the research and implementation processes for the allocation of virtual infrastructures in GEYSERS, VXDL is being extended in order to support the specification of virtual networks with constraints related to optical network technology. For example, virtual infrastructures can be described with parameters such as the fibre type, number of wavelengths, optical impairment and optical add/drop capabilities. Moreover, VXDL is being extended with energy management parameters, such as power constraints.

Two documents taking into account the latest developments in WP3 and WP5 are in preparation to extend the VXDL specifications:

- The optical network virtualisation extension (specific to GEYSERS).
- The virtual infrastructure energy management extension (specific to GEYSERS).

An open-source version of the VXDL parser has been developed and can be downloaded from the Internet.

The specification of the VXDL language is publically available. Private extensions are made available only for members.

4.1.4.2 VXDL extensions within SAIL

The VXDL Forum, through contributions by Lyatiss, is also active within the EU FP7 SAIL project. For enabling elastic service specifications, VXDL has been extended with high-level constraints. With this extension, virtual infrastructures can be described with arrays of virtual resources, allowing for scaling up and down their cardinality, and with intervals of capacity. In addition, events and actions can be specified, which allow to reconfigure the service in a virtual infrastructure at given conditions. This kind of elastic service specification is also of interest for GEYSERS, for the re-planning of a virtual infrastructure according to new service demands. One example is the Dynamic Enterprise Information System Scaling use case defined in deliverable D1.1 [GEYSERS-D1.1], which consists in scaling virtual resources up and down based on monitored data and based on the enterprise’s momentary requirements.

An extension of VXDL to integrate OpenFlow has also been written.

4.1.4.3 VXDL presentations

The VXDL Forum aims at raising the awareness for Cloud infrastructure modelling and for the VXDL language. Both have proved their strength for expressing in a very convenient manner, network resources capacity dynamically provisioned and used. VXDL is capturing the infrastructure profile and footprint of any Cloud deployment. Lyatiss has given presentations on VXDL and the work of the VXDL Forum at the following workshops in 2011:

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- 2nd Future Network Technologies Workshop of ETSI by Pascale Vicat-Blanc, Sophia Antipolis, France, September 2011.
- ISOD workshop in the session on Industry Developments on Cloud Based Infrastructure Services at the Open Grid Forum 33, Lyon, France, September 2011.

During the year, Lyatiss has also presented the language to different vendors such as Docomo, Huawei, Alcatel Lucent, Ericsson, HP, Bull, Juniper, Cisco, IBM, VMware, Citrix, Dell, Arista, Intel, Broadcom and to different Telcos: Orange, SFR, Colt, Deutch Telecom, Verizon.

In the coming year, the plan is to consolidate the activity and push VXDL adoption through a larger promotion of open-source VXDL parser and free dissemination of CloudWeaver for DevOps in public Clouds.

4.2 WP6 report on standardisation activities in 2012

During 2012, the following standardisation activities were performed:

Title	Title of Organisation or event	Status	Date of publication	GEYSERS author(s)
On-Demand Infrastructure Services Provisioning Best Practices, version 0.1	ISOD-RG draft document, OGF33 (Lyon)	In preparation	End 2012	Yuri Demchenko (UvA) (coordinator)
Cloud Reference Framework	IETF	Submitted	End 2012	B. Khasnabish (ZTE USA, Inc.) J. Chu, S. Ma, Y. Meng (ZTE) N. So (Tata Communications) P. Unbehagen (Avaya) M. Morrow (Cisco Systems [Switzerland] GmbH) M. Hasan (Cisco Systems) Y. Demchenko (UvA)
SDF profile for on-demand Infrastructure services provisioning	Use case submission to TMF	In preparation	TBD	Yuri Demchenko (coordinator)
Cross Stratum Optimisation enabled Path Computation	IETF 83 (Paris)	Submitted	March 2012	N. Ciulli (NXW) L. Contreras – O. Gonzalez de Dios (TID)



Title	Title of Organisation or event	Status	Date of publication	GEYSERS author(s)
Virtual Infrastructure Modelling language - energy extension - optical resource extension	VXDLforum	In preparation	End 2012	F. Anhalt, S. Soudan, P. Vicat-Blanc (Lyatiss)

Table 4-2 - WP6 report on standardisation activities in 2012

4.2.1 IETF: Cloud Reference Framework

A draft entitled “Cloud Reference Framework” has been submitted in IETF. The document presents a Cloud-based system using virtualised computing/communications/storage resources and applications. In the emerging Cloud-based systems, virtualised infrastructures and services are provisioned on an on-demand basis, and configured for specific customer needs or tasks. The reference framework is based on the survey of the SDOs and WGs that are focusing on Cloud-based systems and services (Cloud SDO, I-D.Khasnabish-cloud-sdo-survey) and other research and developments in the Cloud technology area. Both intra-Cloud and inter-Cloud reference frameworks are presented and the requirements of each layer are discussed.

4.2.2 IETF: 83

A draft entitled “Cross Stratum Optimisation enabled Path Computation” has been submitted for 83rd IETF meeting held in Paris on the end of March. The contribution presents different architectural options to positioning the PCE as a central element in a comprehensive CSO solution. The GEYSERS architecture can be accommodated in some of these options, and future work could comprise a detailed description of the matching among GEYSERS and the currently proposed options. The work has been co-authored by Huawei and GEYSERS partners (Nextworks and TID).

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5 Conclusions

This deliverable has presented the standardisation activities and the strategic standardisation approach for the GEYSERS project that allows the engagement of research resources in a focused manner. The standardisation activities are tailored to identify fields of the standardisation bodies that should be affected by the GEYSERS experience. The strategy used to identify the standardisation activities and the standardisation bodies was focused on two iterative steps. The first of these impacts the creation of the GEYSERS awareness, where the standardisation community was prepared to consider the results of the GEYSERS experience in their work. The second was focused on the transformation of the GEYSERS results into standards documents and implementations.

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7 Acronyms

AAA	Authentication, Authorisation, and Accounting
API	Application Programming Interface
ACM	Association of Computing Machinery
CSA	Connection Service Architecture
CSSI	Common Security Services Interface
DMTF	Distributed Management Task Force
EMAN	Energy Management Working Group
GMPLS	Generalised Multi-Protocol Label Switching
GSS	Global Secure Systems
IaaS	Infrastructure as a Service
ICT	Information and Communications Technologies
IEEE	Institute of Electrical and Electronics Engineering
IETF	Internet Engineering Task Force
IT	Information Technology
LICL	Logical Infrastructure Composition Layer
MIB	Management Information Base
MPLS	MultiProtocol Label Switching
MSS	Management Support Service
MVNO	Mobile Virtual Network Operator
NCP	Network Control Plane
NGN	Next-Generation Network
NIPS	Network+IT Provisioning Service
NMP	Network Management Plane
NSA	Network Service Agent
NSF	Network Services Framework
NSI	Network Service Interface
OAM	Operations Administration and Maintenance
OGF	Ope Grid Forum
OSA	Optical Society of America
PaaS	Platform as a Service

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PCE	Path Computation Engine
PoE	Power over Ethernet
PoP	Point of Presence
SaaS	Software as a Service
SES	Software Enabled Services
SES-MS	Software Enabled Services Management Solution
SLA	Service Level Agreement
SML	Service Middleware Layer
TMF	TeleManagement Forum
UCLP	Universal Commerce Language and Protocol
UNI	User-to-Network Interface
VI	Virtual Infrastructure
VIO	Virtual Infrastructure Operator

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