Service Level and Delivery Management in e-Infrastructures – Lessons learned in gSLM project

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1 Motivation

1.1 Introducing Service Level Management (SLM) and Service Delivery Management (SDM)

Providing an IT service involves more than technology. IT services, whether simple or complex include the technical aspects of the service, but also legal, administrative and managerial aspects. The non-technical aspects are as important as the technical ones, as without them the neat technology cannot easily be provided as a service to real customers.

Service Level Management (SLM) and Service Delivery Management (SDM) are the sets of processes used to define, agree, record and manage the provision of a service[1]. They provide structured approach to the lifecycle of service provision, from offering service catalogues to negotiating enforceable legal agreements, coping with service failures and closing agreements. While it has legal elements and can specify technical metrics, it also pays attention to reaching common understandings and other human elements in the service domain.

On the commercial IT service sector, SLM-SDM is a mature area, a component of IT Service Management. Several internationally accepted systems for SLM-SDM exist, notably ITIL, ISO/IEC 20000 and eTOM. However, these systems have not been used in the e-Infrastructure domain beyond small-scale pilots focusing on the activities within a single site.

1.2 Short intro to e-Infrastructures

The European Commission states that e-Infrastructure activities aim at:

> *"…empowering researchers with an easy and controlled online access to facilities, resources and collaboration tools, bringing to them the power of ICT for computing, connectivity, storage and instrumentation. This allows for instant access to data and remote instruments, "in silico" experimentation, as well as*

[1] Paraphrasing the commonly approved international standard for IT Service Management, ISO/IEC 20000, see http://www.iso.org/ or http://goo.gl/VBHV3

the setup of virtual research communities (i.e. research collaborations formed across geographical, disciplinary and organisational boundaries).[2]

The e-Infrastructure landscape includes several different technology platforms, such as supercomputers, grids and clouds as well as data infrastructures and networked sensor systems, These have generally grown out of the academic domain and experimental systems developed in universities and research centres.

1.3 SLM-SDM in federated Infrastructures – why grids are (still) interesting?

In the modern e-Infrastructure landscape the academic community has developed most of the new distributed IT services. These have been created by and used in a fairly informal environment, with mostly unofficial agreements between participants used to simplify the process and lower the administrative barriers that might impede development. Now, as these infrastructures have matured and are increasingly used in mission critical systems, their operation and management are becoming more formalised. The gSLM project supports this formalisation by bringing in knowledge from the commercial SLM-SDM community built up over many years of provision and management of commercial IT services.

Grid infrastructures are an interesting topic of research, since during the decade of distributed service provision to a growing user communities, several organisational practices have evolved. These practices – while often informal – have made it possible for the service providers to offer services that have satisfied the requirements of large, globally distributed user communities. Understanding the nature, benefits and limitations of these practices will be an important part in both successful application of new generation of e-Infrastructure service solutions and in trying to generalise these collaboration models and apply them in other sectors of the society.

These models may also provide input for improving service provision in other areas. Notably, grids are federated rather than unitary infrastructures, and other federated systems will face many of the same challenges as grids. Perhaps most notably, multi-cloud systems must integrate resources from heterogonous providers in he same way grids integrate heterogeneous recourses from multiple sites.

Improved service provision, in grids, clouds or other e-Infrastructures, also facilitates the assessment and comparison of costs and service quality. This is increasingly important in a era of reduces research budgets and a greater emphasis on users such as those represented by ESFRI projects[3]. It seems likely that as time goes on, users and projects will be asked to demonstrate the efficiency and cost effectiveness of the infrastructures

[2] Taken from http://cordis.europa.eu/fp7/ict/e-infrastructure/ - accessed 05.05.2011

[3] See http://ec.europa.eu/research/infrastructures/index_en.cfm?pg=esfri for details – accessed 05.05.2011

they use (and fund, directly or indirectly) and SLM-SDM will play an important role here.

2 gSLM project approach

The gSLM project works on the areas described above, seeking to bring experiences and approaches from commercial ITSM and provide ways to provide them in the grid and e-Infrastructure domain. It is a two-year support project including experts in grid operations as well as formal service level management.

The project will operate through internal and external workshops, consultation with experts and discussion and collaboration with a range of other projects and initiatives, including EGI, PRACE, IGE, mOSAIC and others.

By combining input from these different sources with expertise from the project consortium, gSLM will provide recommendations at a policy level but also at a practical level aimed at e-Infrastructure operators and users.

2.1 Establish common terminology and model

The e-Infrastructure and SLM-SDM fields have notably different terminologies, often using the same terms for different things. By creating a common terminology, gSLM is facilitating communication and translation of concepts and approaches between the two fields. The terminology will be provided in a public wiki during 2011 and experts from both communities will be invited to participate in developing and improving the glossary.

In parallel, the project is setting out an ontology and a set of use cases to represent the main relationships and processes in provision of grid services. These will be used to create a two-part model of grid service provision. The first part will consider the current model of grid relationships, while the second will consider a more idealised model that will facilitate improvement of grid service provision, and also be of interest to other federated infrastructures.

2.2 Study the current approaches and the impact of incremental formalisation

Building on the terminology and model, gSLM will produce supporting material and studies on SLM-SDM in e-Infrastructures. This will come through a requirements catalogue for SLM-SDM in grids and whitepapers on the importance of SLM in e-Infrastructures. These will take input from a variety of sources. These will include input from the gSLM grid model, and user needs that lead from them. It will also draw on surveys, consultation at gSLM events and direct consultation with experts. Equally the

white papers will draw on analyses of Grid theory that show the limitations of the current implementations of Grids without or with minimal SLM-SDM.

The result of this work will be increased backdrop and concrete support for the recommendations gSLM will make later.

2.3 Create roadmap

The final outcome of gSLM will be a roadmap on improving SLM in grids and federated e-Infrastructures. This will draw together the earlier outputs of the project as well as providing tools, techniques and approaches that let all members of the grid and broader e-Infrastructure community to improve service provision at both the practical and policy levels.

After recapitulating the terminology and Grid SLM model, requirements and presenting a summary of the whitepaper on the importance of grid SLM, the roadmap will describe a maturity model for SLM in Grids. Recognising that the maturity of an SLM system needs to map to the maturity of the infrastructure it serves, this will describe appropriate levels of service management through the evolution from an experimental service to an infrastructure in use by a global community.

Following on from the this the roadmap will provide general guidance and setsp for deploying improved SLM, divided into the areas in which they must be applied: Policy & governance, technology, organisational & process change and lastly human & social factors.

These general guidelines will then be used to produce specific prescriptions for different types of actor in the Grid community, showing how users, sites and infrastructures can all take steps to improve service provision.

Finally the roadmap will look forward to consider the impact that adopting the maturity model and recommendations could have on current infrastructures. It will also suggest an approach for future work in the area.

3 Initial results & next steps

Our efforts are currently at an early stage, but we are in the process of creating the SLM-SDM model while organising high profile events to gather input from the SLM and e-Infrastructure communities.

An initial set of terminology and use cases is being produced, which will be made public later in the year. In parallel, the process of creating the final roadmap has begun with scoping exercises and plans.

Work on use cases has already lead to a development of a categorisation of the types of 'contract' within Grids, as they are distinct from and more complex than their equivalents in the commercial sector. As far as SLM is concerned, Service Level Agreements (SLAs) will operate much as they do in the commercial world, defining obligations on service providers to their users. More complex are Operational Level Agreements (OLAs) and Underpinning Contracts (UCs) that conventionally describe service agreements between components of a larger organisation, or between organisations that together contribute to an end user service respectively. The federated nature of Grids means that many relationships that would be described in OLAs in industry, such as between data centres in a single cloud provision organisation, are actually between sites that are distinct legal entities, making them closer to UCs. UCs will generally have to be stricter or more formalised than OLAs, as they will be between organisations, yet in the Grid sector they remain extremely informal. As far as the SDM use cases are concerned we have right now identified seven categories of processes that are relevant to Grids like service configuration, service availability, service continuity, service capacity and others.

Equally it is necessary to create groups of actors within Grids that can be used for modelling purposes. A simple schema for these could be:

- Virtual Organisations (users/clients)
- Grid Infrastructures (GIs – used as a common name for varying levels of infrastructure)
    - These can include National Grid Infrastructures or regional/international Grid Infrastructures such as EGI.
- Sites
- External suppliers

Already these components can begin to be assembled into an initial maturity model. This originates from the realisation that experimental services cannot be set in stone and burdened by excessive formalisation while it is unwise to build services designed to scale to many thousands of users on a basis of informal processes with no consequence for service failures, leading to unhappy (or no) users. One aspect of the maturity model is dividing the existing *de facto* contractual relationships to ones that can be formalised efficiently and that should be the focus of the SLM-SDM efforts (e.g. "VO-GI" or "GI-higher level GI") , and the ones that should be considered only in the experimental stage (e.g. "user-site" or "VO-site").

The next steps in this process will be carried out largely through external workshops that let the gSLM community. Two workshops are planned for 2011, one in May as part of the global ITSM even, IM2011[4] as part of the BDIM2011 workshop[5] and the other a one day workshop on Managing and Delivering Grid Services[6] as part of the Euro-Par 2011 event[7].

[4] See http://www.ieee-im.org/ for details
[5] See http://www.bdim2011.org/Workshop/Welcome.html for details
[6] MDGS2011, see http://gslm.eu/mdgs2011 for details
[7] See http://europar2011.bordeaux.inria.fr/ for details

Alongside this the project is carrying out case studies on organisation in the e-Infrastructure field to look into how they approach and implement SLM in their operations. By choosing representative organisations and examining them in depth, facets of the SLM challenge can be elucidated and new approaches can be planned.

4 Relevance to the software and services domain?

The vision of dynamic service composition and re-composition based on a pay-as-you-go model with mostly bilateral service contracts between the providers and consumer does seem to be quite far away from the traditional e-Infrastructures. Especially the NGI/site hierarchy may seem to restrict the applicability of the gSLM results to the software and services domain.

However, gSLM relies on a number of use cases that describe service-level management requirements common to IT service provision and independent of the actual middleware or provider consumer relationship. Moreover, the model adheres to industry-standard, widely used concepts and specifications like ITIL or ISO 20000. Therefore we are confident that the SLM-SDM model defined by gSLM carries commonalities that also apply to service-oriented ecosystems.

We would also assume that once the demand for stronger service level guarantees for the service-oriented solutions grow, the providers will have an interest to build arrangements that allow them to honour their service level agreements also in cases where their own infrastructure fails. These agreements will bear resemblance with the SLM_SDM structures modelled by the gSLM project.

In particular, it would be interesting to discuss how to map the roles of the sites, NGIs, and EGI to the software and services ecosystem. For many years, researchers, organised in virtual organisations, shared resources following the grid paradigm. Existing grids represent significant investments, not to mention the knowledge created developing, building, operating and using them. Current developments now change the infrastructure landscape significantly and one particular question is how to transfer the results and benefits of grids to cloud-like approaches. Therefore we regard the discussion of questions like

- “could a cloud broker, providing access to several clouds (by directly or indirectly passing on the clients’ credit card info), take the role of a VO authenticating users that belong to the it?” or
- “does a common SLM-SDM model for selected use cases serve grids as well as cloud-like infrastructures?”

as important, and see the results of gSLM as a valuable contribution towards future solutions.