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Executive Summary

The purpose of this use case is to provide a generalised grid scenario with emphasis on Service Level Agreements, Service Assurance, and Data/Compute resources. The financial sector is used as the exemplar.

The financial grids use case provided by BeSC [1] is based around typical requirements taken from the Finance sector in particular applications including Implied Volatility and Risk Management (analysing the risk of a portfolio of stocks/ bonds). Some of these requirements will include requirements taken from outputs from the existing FP6 IP project NextGRID [2] and extend the preliminary work which has been done in that project. Both applications will drive the requirements for the BeSC generalised grid scenario use case.

The key objectives of this work package will include:

- Define generalised grid SLAs based on the use case scenarios, with a focus on specific non-functional sector requirements.
- Implementation of the prototype demonstrator with support for Service Assurance, and dynamic deployment requirements.
- devising SLAs to support handling sensitive end-user information

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1. Use Case Introduction

The financial sector depends heavily on process and data intensive computations to deliver competitive advantages. Financial applications are particularly suited to grid-based experimentation and research. Many applications involve both process and data intensive computations.

This use case is intended to

1. integrate a use case that is rooted in an important business domain.
2. integrate a use case that has stringent performance requirements.
3. integrate a use case that has strict security requirements.
4. integrate a use case that has stringent regulatory requirements.
5. provide consistency with previous FP projects by integrating a NextGRID [2] use case.
6. provide a quick-win demonstrator by drawing on the work of NextGRID [2].

2. Scenario Introduction

2.1 Actors

The use case scenarios have the following generic actors.

Table 1: Use Case Actors

Financial Service Customer	a consumer of processed market data.
Financial Service Provider	a business that sells processed financial or market data to a collection of users.
Software Provider	that provides software, via a licensing agreement, to businesses.
Compute Provider	that provides a hosting and compute capability to users.
Data Provider	that provides a feed of up-to-date market data for businesses.

2.2 Problem Statement

A Trading System processes live market data from the Data Provider using compute resources hosted by the Compute Provider, running software from the Software Provider to supply processed data to the customer.

A Trading System demands a high availability of resources. Non-availability of resources means an absence in market trading which, in turn, can lead to missed opportunities. Security is of paramount importance. In addition, regulatory issues exist within institutions that place restrictions on the accessibility of spatial information across their distributed enterprises.

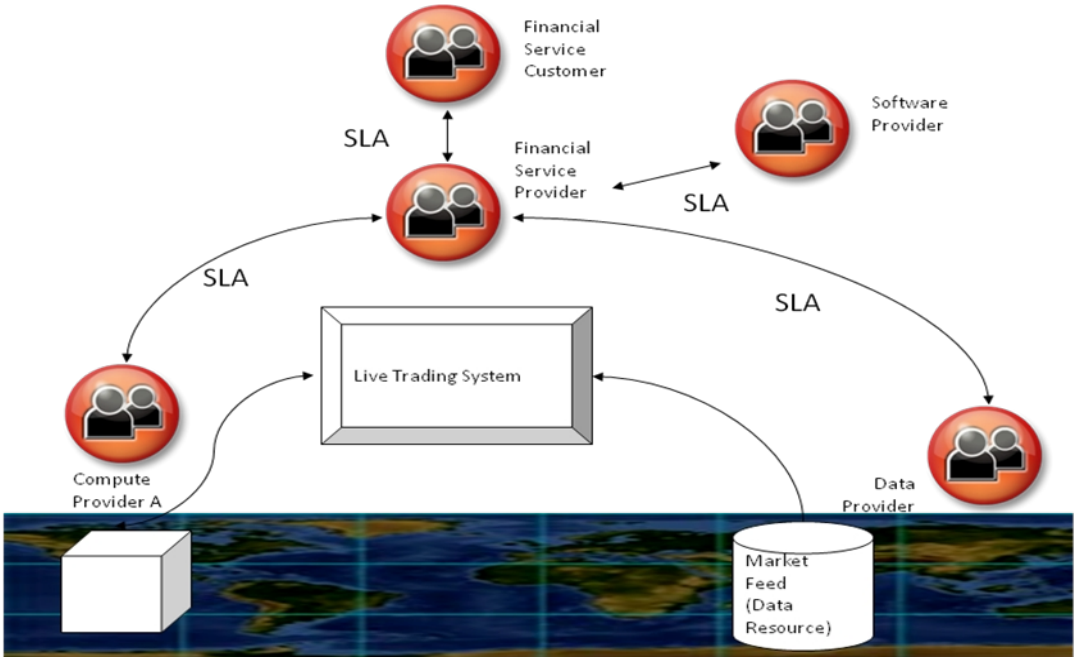

Figure 1: Infrastructure and SLA Overview

As described in Figure 1, Financial Service Provider supplies the trade data from the Live Trading System to the Financial Service Customer. The business SLA is agreed offline between the Financial Service Customer and Financial Service Provider. In order to meet the business SLA requirements, the Financial Service Provider need to establish separate SLAs with the Software Provider, Compute Provider and Data Provider. These SLAs need to be monitored and observed carefully.

2.3 Opportunity

The following table illustrate a generic SLA relationship, which present an opportunity for SLA@SOI framework to be utilised in this use case.

Table 2: Generic SLA Relationship Overview

SLA Actors	SLA Overview
Financial Service Customer and Financial Service Provider	An SLA links the customer to the provider in respect of the provision of processed market data. The SLA will • define nature of the processed data; • define a QoS requirement for the supply of data; • defines an acceptable outage time and a failover consequence.
Financial Service Provider and Software Provider	An SLA links the service provider and software provider in respect of using software. The SLA will • define when and how the software can be used; • how many distinct copies of the software can be used concurrently; • how, when and for how long the software is updated and maintained by software provider for the service provider.

Financial Service Provider and Data Provider	An SLA links the service provider and the data provider in respect to providing market data. The SLA will • define the nature of the market data provided; • define a QoS requirement for the supply of data; • defines an outage time and a failover consequence.
Financial Service Provider and Compute Provider	An SLA links the service provider with a compute provider in respect to providing compute and hosting capability. The SLA will • define the compute nodes that will be provided; • defines a QoS requirement for the compute nodes; • defines a QoS in the provisioning of the compute nodes; • define an outage time and a failover consequence.

The following diagram illustrates a SLA focused scenario.

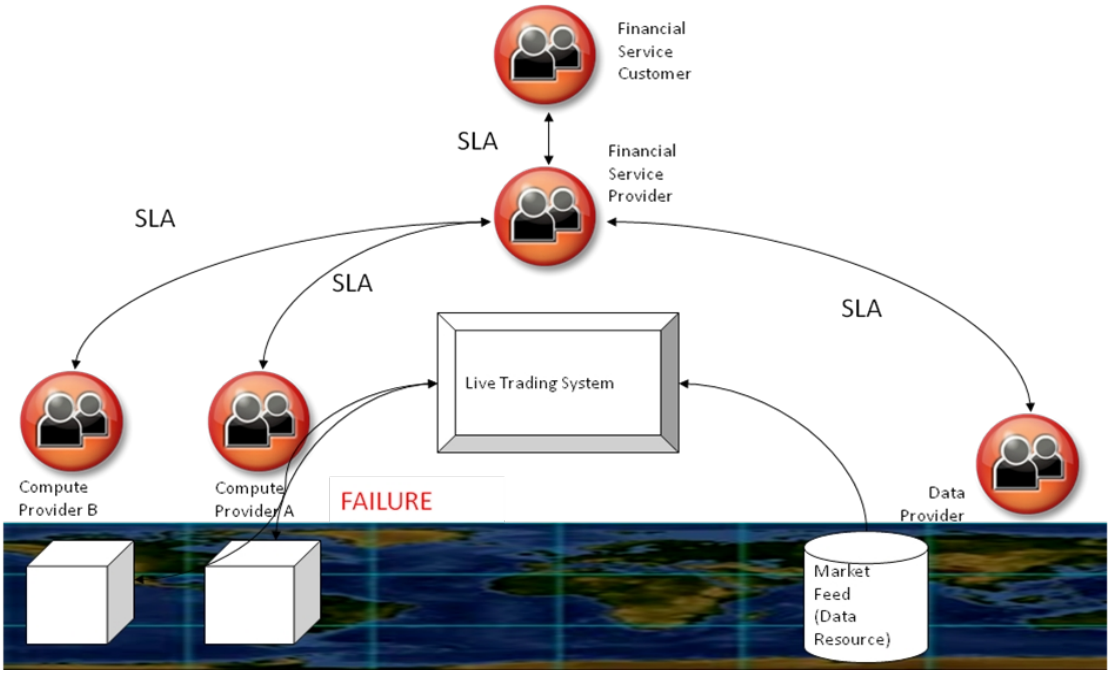

Figure 2: SLA Focused Scenario

The scenario that this use-case will address attempts to highlight the SLA interaction between the various actors.

2.3.1 From the Customer Perspective

The scenario illustrates that the SLA between the Customer and the Service Provider is fulfilled without the customer being aware of failure and the interaction with other SLAs that exist in the architecture; i.e. that the data, QoS, outage requirements between the Customer and the Service Provider are fulfilled or the SLA consequence occurs.

2.3.2 From the Service Provider Perspective

The scenario illustrates that the SLAs for the Service Provider are fulfilled. The Service Provider is a data processor and relies on compute facilities.

The compute provider is assumed to fail and under the SLA between the Service Provider and the Compute Provider, a fail over compute provider is provisioned and the Trading System is re-established automatically.

This use case should illustrate that all the SLA that exist are monitored, enacted and enforced.

3. Scenario Details

Two generalized scenarios have been defined and will be used as the basis for specification, requirements and demonstration.

Table 3: Use Case Scenario Actors

Entity	Name	Description
Financial Service Customer	ABS	ABS is a Mid range building society operating mainly in the domestic saving/mortgage market. It runs its own internal IT organisation looking after core business but often buys in external services for specialists.
	HF	HF is a small organisation who invests on behalf of individuals with financial institutions in order to participate in a wider range of investments than may be feasible for an individual investor. HF has been sometimes characterized by unconventional strategies. Very limited IT infrastructure and use financial service companies to supply processed market data.
Financial Service Provider	ABC Financials	A recognised and respected service provider in the financial sector. Using their market and software expertise they have developed numerous services available to financial community.
Compute Service Provider	SDE	SDE provides a broad portfolio of business and technology solutions to help its clients worldwide improve their business performance. Via their central compute centre based in the UK processing power can be leased by external customers.
	Mass-Storage	Mass-Storage was founded with the desire to offer the highest quality Mass Storage & Internet Hosting solutions available. Data storage can be leased by external customers.
Data Service Provider	Reuters	Reuters is a global information company providing indispensable information tailored for professionals in the financial services, media and corporate markets. Our information is trusted and drives decision making across the globe. We have a reputation for speed, accuracy and freedom from bias.
	Bloomberg	Bloomberg is the leading global provider of data, news and analytics. The BLOOMBERG TERMINAL™ and Bloomberg's media services provide real-time and archived financial and market data, pricing, trading, news and communications tools in a single, integrated package to corporations, news organizations, financial and legal professionals and individuals around the world.

3.1 Storyboard

3.1.1 Scenario A

ABS needs to periodically revalue a portfolio of Exotic Derivatives to comply with internal Market Risk controls as well as regulatory requirements. These Derivatives are highly complex, often requiring computationally intensive numerical techniques to price.

ABS has limited in-house skills and is not prepared to invest in developing their own in-house solution due to the periodic nature of the requirement. A regulatory stipulation is that none of this data can be held or transmitted outside the UK. A number of Financial Service Providers have developed an on-line portfolio re-valuation service that provides the results and ABS has contracted with ABC for 12 months to provide these pricing facilities.

The basic service requires 1 high end Compute power for a 12 hour period each day. This will cover day to day re-valuation operations on a number of small to medium portfolios. If however several large portfolios are to be valued at the same time then extra Compute power will be required. Usually this requirement will be known before hand and with a 2 day notice period ABC can arrange for additional Compute resources to be configured.

The basic compute unit will need to have at least a 2.00GH processor with 8GB RAM and 30GB of local storage as well as a software bundle of Solaris and C++ compiler. ABC contracts SDE to provide the Compute resources as their service are more tailored to flexible Compute demand and also provides limited data storage capacity as well. Another factor is that all their facilities are UK based so there is no risk of data being transmitted or held abroad. All market data will be supplier from a Bloomberg data feed.

The key performance indicators are defined as follow.

Table 4: Key Performance Indicators – Scenario A

Category	Service Level Objective (SLO)
Computer Power Availability	99.99% uptime during the 12 hour period.
Storage Availability	99.99% uptime during the 12 hour period.

3.1.2 Scenario B

HF needs access to applications and computing power on demand to "back test" scenarios they believe will be profit generating. This will require 2 years of historical data from the London and New York Stock Exchanges to run their simulations against. This historical data will need to be from a certain source with guaranteed independent quality level and integrity. (e.g. Dataset provided with provenance from source XYZ, was data cleansed by mechanism XYZ123 and last independently audited within the last 4 weeks)

This historical data plus third party price verification services will feed into their own development system which will in-turn evaluate each scenario. As this is a development system they will require the ability to stop and re-start services on an ad-hoc basis.

HF has a maximum budget of £5,000 per month for this project. Technical requirements will include a guaranteed response time of less than 100ms between a certain time range in the day. (e.g. 0800 – 1800 GMT)

HF has previously used ABC Financials to supply similar services that they require. They have agreed a 3 month contract with ABC who will supply the historical data and financial service data. There is a possibility that this contact may be extended by a month depending on results.

Processing power is not as important in this situation as it will not affect live trading and so many of the simulations can be run in off-peak periods. A compute unit comprising of at least a 2.00GH processor with 8GB of RAM and 50GB of local storage. The service will require a Windows NT/.NET platform. To hold the historical data and results, a Data Storage unit with at least 100GB is required. As a result ABC have chosen to use SDE to provide the Compute power as they offer a competitive off-peak service where the customer understands that in periods of high demand their application may be taken off line to satisfy unforeseen market demand.

ABC will use Mass-Storage to archive the data for later analysis. The required market data will be obtained from ABC internal historical archives.

The key performance indicators are defined as follow.

Table 5: Key Performance Indicators – Scenario B

Category	Service Level Objective (SLO)
Computer Power Availability	99.99% uptime between 0800 to 1800 GMT. 99% uptime between 1800 to 0800 GMT.
Data Availability	99.99% uptime between 0800 to 1800 GMT. 99% uptime between 1800 to 0800 GMT.
Storage Availability	99.99% uptime between 0800 to 1800 GMT. 99% uptime between 1800 to 0800 GMT.
Response Time	<= 100 ms between 0800 to 1800 GMT. <= 500 ms between 1800 to 0800 GMT.

3.2 Architecture

The Financial Use Case demonstrator will be built on top of the SLA@SOI framework architecture.

The SLA for this use case is not negotiated automatically. The SLA between the Financial Service Customers and Financial Service Provider has to be agreed offline. The SLA@SOI E-Contracting component should be allowed to register the agreed negotiated SLA contract. The E-Contracting component should also allow the Financial Service Provider to include third party services (e.g. party price verification service). This information should be managed by the Negotiation component provided by SLA@SOI framework. The Translation component in the Negotiation module should be aware of the mapping of the business SLA into lower level SLAs. Re-negotiation of the SLA contract should be allowed when extra resources are needed.

The Provisioning and Infrastructure component provided by SLA@SOI should be allowed to provision the necessary software and infrastructure resources as negotiated in the SLA. The Monitoring and Adjustment component needs to be aware of any resource failure and to notify any re-provisioning actions in order to enforce the SLA.

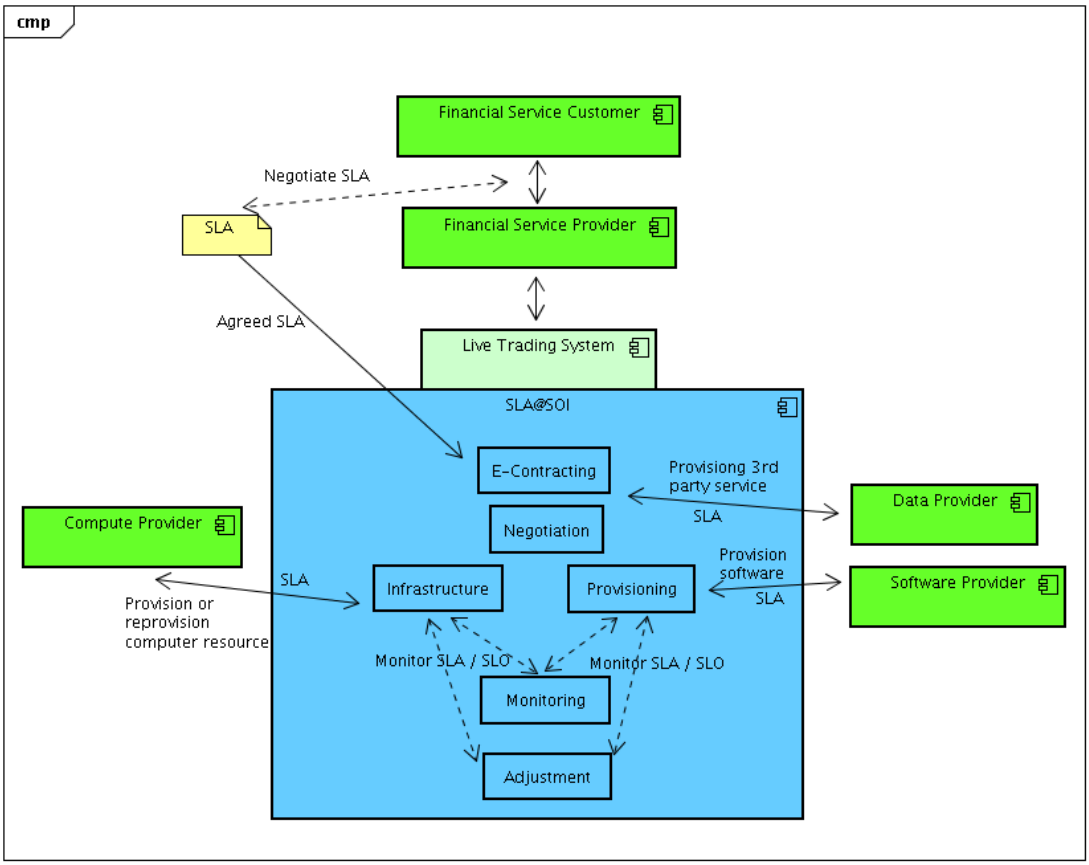

Figure 3: Overview Architecture Diagram

3.2.1 SLA Requirements

In this section, we summarize a set of generic SLA requirements for the Financial Grid applications.

3.2.1.1 Performance Requirements

- Computer Power Availability (e.g. One high end Compute power for a 12 hour period each day)
- Storage Availability (e.g. Data storage unit 100GB to hold historical data & results)
- Data Availability (e.g. Availability of historical data for computation)
- Response Time (e.g. Guaranteed response time of under 100ms between 0800 and 1800 GMT)

3.2.1.2 Compliance Requirements

- Regulatory compliance (e.g. No data can be held or transmitted outside the UK.)

3.2.1.3 Data Requirements

- Data quality and integrity (e.g. Data will need to be from source XYZ and have been cleansed by mechanism XYZ123 and last independently audited within the last 4 weeks)
- Data verification (e.g. Prices will be verified using 3rd party price verification service)
- Historical Data (e.g. 2 years of historical data from London and New York Stock Exchanges)

3.2.1.4 Operation Requirements

- Service operation (e.g. Ability to stop and re-start services ad-hoc; Simulations can be run off peak)
- Resource addition (e.g. Extra compute power must be made available if several large portfolios are to be valued simultaneously - contract dictates 2 days notice required)
- Resource Recovery (e.g. Compute resource must be re-provisioned automatically when failed)

3.2.1.5 Platform Requirements

- Compute Unit (e.g. A basic Compute unit of 2GH processor, 8GB RAM, 50GB local storage)
- Operating System (e.g. Windows NT/.NET platform)
- Software (e.g. Solaris and C++ compiler)

3.2.1.6 Finance Requirements

- Budget (e.g. Maximum budget £5,000 per month)

3.3 Coverage

The following table indicate the key SLA features of this use case and the general SLA@SOI requirements as reported in the TRAC system.

Key SLA framework features	Requirement Category	TRAC
1. Customers must be able to select different platform. (e.g. Windows NT, Solaris, Unix, Linux).	Platform	#75
2. Customers must be able to select different software, with restrictions to the platform they have chosen. (e.g. .NET, C++)	Platform	#189
3. Customers must be able to select basic or higher compute unit. A minimum basic compute unit is 2 GHz processor, 8 GB RAM, 30 GB local storage.	Platform	#190
4. Customer must be able to request for additional data storage (other than the basic compute unit).	Operation	#191
5. Customer must be able to request for extra compute power after initial deployment, and this must be made available by giving reasonable advance notice period (e.g. 2 days notice).	Operation	#192
6. Customer must be able to specify the period of peak hours and off peak hours (e.g. Peak hours is from 0800 to 1800 GMT).	Performance	#193
7. Customer must be able to specify the numbers of hours to be made available for the compute unit each day, either during peak hours or off peak hours.	Performance	#194
8. Customer must be able to specify the guaranteed response time, either during peak or off peak hours.	Performance	#188
9. Customer must be able to stop and re-start the services on ad-hoc basis.	Operation	#195
10. Customer must be able to specify that no data can be transmitted outside a geographical region. (e.g. No data can be transmitted outside the UK).	Compliance	#196
11. Customer must be able to request for historical data with guaranteed independent quality and integrity (e.g. Dataset provided from source XYZ must be cleansed by mechanism XYZ123 and last independently audited within the last 4 weeks).	Data	#197
12. Customer must be able to request for historical data from different sources (e.g. 2 years of historical data from London and New York Stock Exchanges).	Data	#66
13. Customer must be able to request for 3rd party data verification service (e.g. price verification service).	Data	#66
14. Customer must be able to specify a maximum budget per month. (e.g. maximum budget of £5,000 per month).	Finance	#198
15. Compute resource must be re-provisioned (fail-over) automatically when failed.	Operation	#52

4. Conclusions

The Financial Grid use case will take advantage of the functionalities offered from the SLA@SOI framework. This use case challenges the SLA@SOI framework to satisfy the legal and data confidentiality requirements that need to be enforced in the financial sector. Other challenging requirements concern the ability to support dynamically re-provisioning when a resource is not available.

An overview architecture of the use case demonstrator is presented. A detail architecture diagram and analysis for the use case demonstrator will be presented in other deliverable documents (Financial Grids Use Case Demonstrator Specification, Prototype Lab Demonstrator for Financial Grids, and Final Field Demonstrator for Financial Grids). In year two, we plan to realise the use case scenarios and develop a demonstrator prototype.

5. References

[1] Belfast e-Science Centre, URL: http://www.besc.ac.uk.
[2] NextGRID: Architecture for Next Generation Grids, URL: http://www.nextgrid.org

Appendix A: Glossary

Please refer to deliverable document D.A1a Framework Architecture for the entries of the SLA@SOI glossary.

Appendix B: Abbreviations

SLA	Service Level Agreement
SLO	Service Level Objective
SOA	Service-oriented Architecture
QOS	Quality of Service