Multi-Cloud

Service Management Pack:

Service Level Agreement (SLA) Business Blueprint

Practical guidelines for a complex challenge

TR197

V1.3

February, 2013

NOTICE

Direct inquiries to the TM Forum office:

240 Headquarters Plaza,
East Tower – 10th Floor,
Morristown, NJ 07960 USA
Tel No. +1 973 944 5100
Fax No. +1 973 944 5110
TM Forum Web Page: www.tmforum.org

CONTENTS

LIST OF FIGURES

1 FOREWORD

This SLA Business Blueprint is part of the Forum's *Multi-Cloud Service Management Pack for Business* aimed at helping readers address the end-to-end management of digital services that are built from multiple cloud-based components. The approach is suitable for managing across multiple types of cloud services, across multiple industry verticals and machine-machine (M2M) services.

This Blueprint pulls together a diverse range of TM Forum assets, and presents them in a simple step by step approach to help business people create and deliver services made up from multiple cloud services provided by partner organisations. The focus is on providing end to end (e2e) Service Level Agreement (SLA) guarantees that are backed up by effective arrangements amongst the component cloud service providers/partners.

This Blueprint introduces:

1. The key concepts for creating e2e SLA Guarantees in straightforward language which is based on the more technical and rigorous definitions in the core TM Forum Frameworx assets. In some cases those assets are designed to support more complex business requirements than described in the examples in this Blueprint. The more complex situations are identified in this Blueprint and the reader is referred to the source assets.
2. A step by step process called PaDIOM (Partner, Design, Integrate, Operate, Monetize) for going from concept to operational SLA Guaranteed service. Each of these stages is described in a simple direct way - supported by example materials and checklists - that explains what needs to be conducted in each stage, and the intended outcomes.

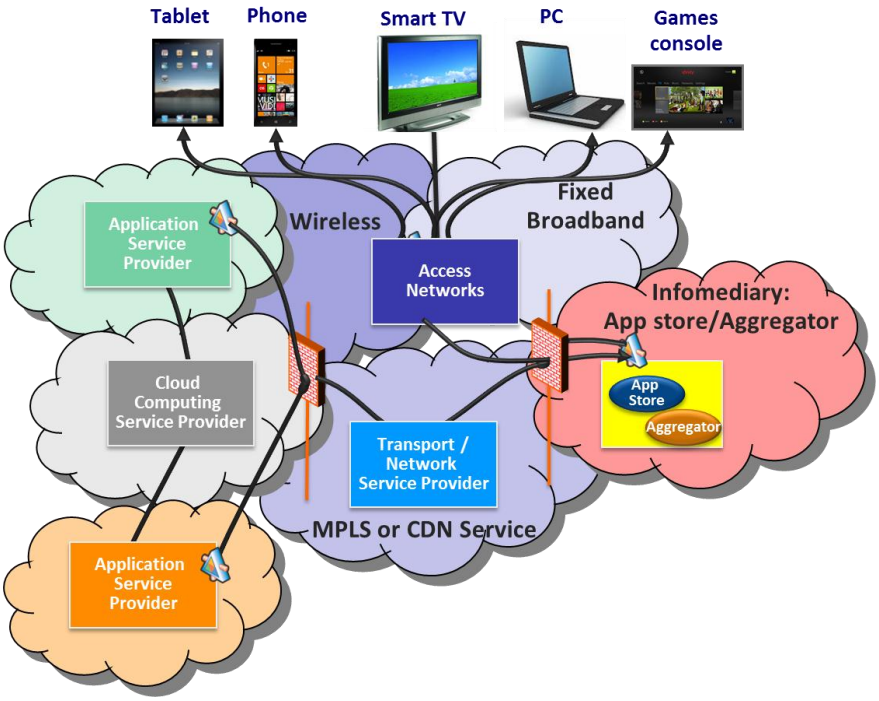


Figure 1 The Multi-Service Nature of Service Delivery

2 EXECUTIVE SUMMARY

The digital world is full of innovative ideas, great marketing and often good access to capital. But unless you can get those services to market rapidly; deliver a great customer experience; fix problems when they occur and collect or apportion revenue while keeping operating costs as low as possible, you won't survive for long. This need for an excellent 'operations experience' is especially true in the market for enterprise-class digital services where companies are increasingly dependent on managed digital services to run their business. They demand reliability, security and a quality of experience that meets their contractual expectations – if the service fails to do that it is not just inconvenient, it directly impacts their ability to operate and their bottom line.

The business of ensuring that service creation and delivery produces highly reliable, predictable and massively scalable services, while keeping operating costs in check doesn't happen by accident: it is a core competency of any successful service provider. This is a complex enough task where the provider has end-to-end control of all of the assets in the service delivery chain but it becomes orders of magnitude more complex where the overall service is comprised of multiple virtual services connected together. Each component service may be manageable on an individual basis, but the end user sees the net sum of all of the operational issues within the ecosystem and the final service provider – the one who contracts with the customer – inherits the problem of managing across the entire chain. Managing the quality of the service through Service Level Agreements in a manner that measures the end-to-end performance of the service is one vehicle for ensuring a positive and predictable customer experience, and is the method that will be described in this Blueprint.

This SLA Business Blueprint focuses on:

- A critical real world challenge that needs to be addressed for operators to achieve excellence in deploying, and operating services, realized by multiple interconnected cloud services.
- An operational view on E2e Service Level Management.
- The management capabilities needed to define monitor and maintain Service Level Guarantees across multi cloud deployments.

INTRODUCTION

WHO IS THIS FOR?

Business people planning to launch multi-cloud services for which e2e SLA Guarantees and management are an essential part of the business proposition.

This Multi-cloud Service Management Pack is designed to bring into one place all the information and reference material to solve an important and growing problem in the deployment and operation of Digital Services including those based on Cloud Service concepts.

HIGH LEVEL BUSINESS SCENARIOS /CHALLENGES

This Multi-Cloud Service Management Pack has two facets. This document is focussed on communicating how business people can use TM Forum SLA Management assets, and is supported by the Developer Pack, which provides technical assets including specifications, guides, interface implementation, and source code.

WHERE DID IT COME FROM?

The material is based on practical implementation experience by TM Forum member companies that have worked together, and are willing to share the learning experiences and best practices evolved to create practical demonstration of these solutions.

This solution leverages the TM Forum SLA Management Guidebook and the Software Enabled Services Team specifications and best practices, as well as TM Forum Frameworx business processes and metrics. The totality of TM Forum specification work covers more management functionality than just SLA management, and these other capabilities will be presented in additional future Packs.

KEY BUSINESS VIEW CONCEPTS

This Blueprint considers the full lifecycle from the concept of a service through to the operational delivery and collection of revenue for a service based on composing services from multiple cloud providers.

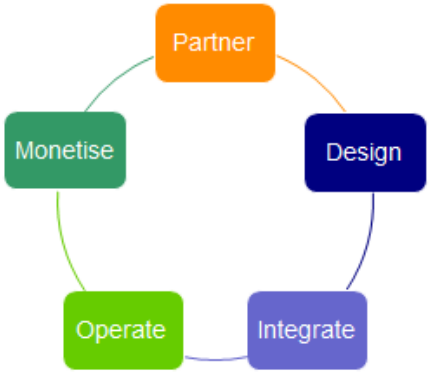


Figure 2 Digital Service lifecycle stages

The full service lifecycle (Partner, Design, Integrate, Operate, Monetize - PaDIOM) addresses both business and technical considerations. Business considerations focus on Partner, Operate and Monetise aspects of the lifecycle, and they also influence the Design and Integrate requirements. The Design and Integrate functions are for the most part the realm of development and IT. These technical aspects are covered in a companion document for developers, the developer pack. Each of these lifecycle stages is explored in the following sections and the relevant Forum assets are presented, including best practice, use of standards, and check lists.

Throughout the Digital Service Lifecycle delivered by multiple partners there are four concepts that must be clearly defined:

1. Business Models
2. Processes operated between partners
3. Products and services offered by one partner to another
4. Contents of a Service Level Agreement amongst the partners

The business model chosen by the partners provides the context for analysis and development of items 2 to 4 above.

BUSINESS MODEL TEMPLATE

Element	Sub-element
Business model	Name
	Short description
	Market players/ competition
	Maturity level
	Priority
Customer/Market	Customer Segment
	Channel
	Relationship
Product Offering	Value proposition
C2M (Concept to Market)	Key Activities
	Key Resources
	Key Partners
Enterprise Management	Cost Structure
	Revenue Streams
Barriers	Business related
	Technical
Drivers	Strategic portfolio
	Revenue Streams
Touchpoints/Use Cases	Upstream
	Downstream
Impact on other TM Forum projects	Business Process Model
	Information Model
	Other projects

From TR 174 [2] CANVAS Osterwalder [4]

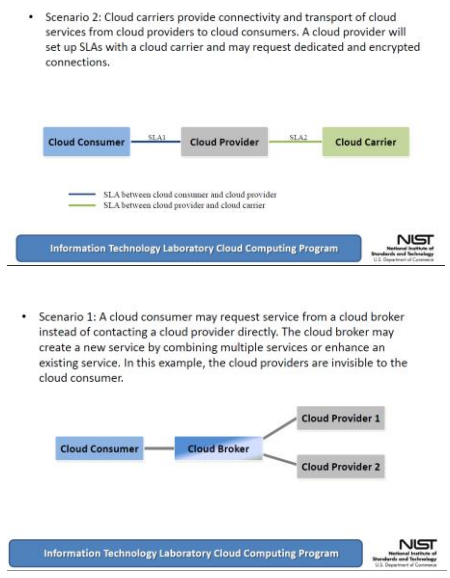
BUSINESS MODEL

In any multi-cloud service delivery value chain the starting point is to define a business model amongst the partners. The Business Model captures:

1. The e2e processes support by the business model value chain and the supporting processes operated between the partners
2. The roles each partner plays
3. The products and services offered by one partner to another
4. The terms and conditions of the business model including Service Level Agreement (SLA), SLA Guarantees, and any financial remedies.

The TM Forum approach assumes that any reasonable business model should be supported by e2e SLA Management and that the techniques proposed should not place any limitation or bias towards any specific business model, but should capture any legal or regulatory requirements imposed on partners.

NIST CLOUD REFERENCE MODEL SCENARIOS



From TR 174-A [2]

The approach used in the TM Forum's Enterprise 'Cloud Infrastructure as a Service IAAS study' TR174 [1] [2] is to take the Enterprise end consumer service requirements and to analyse them using two business scenarios from the National Institute of Standards and technology (NIST) Cloud Reference Architecture [5] shown in the box on the left. The NIST scenarios are analysed using a formal Business Model technique called Canvas [4]. This analysis method identifies a number of aspects that need to be captured in order to precisely define the business model that underpins the intended value chain amongst partners.

The Canvas based template used for analysing the Business scenarios is shown in the break-out box above.

The breakout box below shows the analysis of one of the NIST Business models using the template shown above.

EXAMPLE BUSINESS MODEL

From TR 174-A

<table>
<tr><td rowspan="3">Business model</td><td colspan="2">Name</td><td colspan="2">Short description</td></tr>
<tr><td colspan="2">NIST Cloud Scenario 2:
Cloud Provider/Carrier delivers assured SLA</td><td colspan="2">In this Business model the Cloud Provider holds the commercial relationship with the Cloud Customer and manages the relationship with the Cloud Carrier. It does this based on the value of Cloud Carrier products and services and SLA guarantees that have values that are set statically or dynamically.</td></tr>
<tr><td colspan="2">Market players/competition</td><td>Maturity level</td><td>Priority</td></tr>
<tr><td colspan="2">Cloud Customer
Cloud Provider
Cloud Carrier</td><td>immature</td><td>High (for NIST)</td></tr>
<tr><td rowspan="2">Customer/Market</td><td>Customer Segment</td><td>Channel</td><td colspan="2">Relationship</td></tr>
<tr><td>Government
Large enterprises</td><td>Typical enterprise custom offer
No channel needed (operator brand is usually invisible)</td><td colspan="2">• Policy based Self Service for user ,
• B2B relationships for policy exchange and bulk operations (e.g. Configuration reporting, SLA Report -Key quality /performance indicators- usage and financial)</td></tr>
<tr><td>Product Offering</td><td colspan="4">Value Proposition
To Cloud Customer: complete product to the enterprise; single supplier, one SLA, one point of escalation, and one bill.
To Cloud Provider: complete solution to customer(one stop shop), direct control of all contracts to supporting Cloud Carrier(s), no complex coordination with other parties without a direct commercial relationship.</td></tr>
<tr><td rowspan="2">C2M</td><td>Activities</td><td>Resources</td><td colspan="2">Partners</td></tr>
<tr><td>• One stop shop
• Single point of contact B2B Assume all the risks implicit in customer requirements - especially flexibility, on demand capacity and SLA guarantees.
• Dynamic Value package linked to capacity and SLA</td><td>Cloud Provider:
• SaaS appropriate to customer need
• Computing platform Virtual machine PaaS
• Wholesale Contractual relationship with Cloud Carrier(Iaas/Naas)</td><td colspan="2">Wholesale relationship with one of more cloud carriers having managed network access with managed QoS e.g. Possibly metro Ethernet VLAN with managed QoS and DSL services support IPsec VPN with managed QoS with full automated B2B interface for fulfilment and assurance include SLA jeopardy and capacity forecasting /planning.</td></tr>
<tr><td rowspan="2">Enterprise Management</td><td colspan="2">Cost structure</td><td colspan="2">Revenue streams</td></tr>
<tr><td colspan="2">For Cloud Provider:
• Enterprise bespoke service bid costs
• Cost of outsourced access service to meet varying capacity demands and stringent SLA guarantees over a wide range of applied demands on the access service
Cloud Carrier:
• Managing capacity to meet SLA and financial penalties agreed with CP.</td><td colspan="2">• Consumer pays Cloud Provider
• Cloud Provider pays wholesale access cost with guaranteed SLA over a range of access capacity demand (average and peak bit rate)
• Transaction revenues: Pay on demand, SLA on demand.
• Recurring revenues
○ Option 1: Cloud Provider takes SLA rebate risk if SLA not met.
○ Option 2: Cloud Carrier takes SLA risk if access SLA not met.
• Shared Revenue: Revenues and SLA risk split</td></tr>
<tr><td></td><td colspan="2">Business related</td><td colspan="2">Technical</td></tr>
<tr><td></td><td colspan="2">For CP:
• Very difficult to compete with access provide due to heavy CAPEX investment and operational skills</td><td colspan="2">• Customers want complete flexibility of ‘on demand’ service provision together with guaranteed SLAs. Typically SLAs are</td></tr>
</table>

The Enterprise Cloud Requirements TR174 [1] are analysed using the example business models [2] - including the one shown above - to determine the impact of Enterprise SLA requirements on the individual SLAs offered by each partner in the two business model analysed. The results of that SLA impact analysis for NIST Scenarios are recorded in TR174-B. [3].

A key benefit of this approach is that any business model can be formally captured, and traditional Service Providers can in principle choose to perform any role in any business model. The approach gives a consistent approach to defining the business model and the supporting SLA management arrangements irrespective of

the specific partnering arrangement. TR 174 is a complete worked example for this method of analysis and breaking down e2e SLA requirements, for two NIST based business models into the SLA requirements on the individual partners. For further detail beyond the above example and template, please refer to this document.

PROCESSES BETWEEN PARTNERS

In the business model, business arrangements are defined that cover both:

- The processes that need to be offered to support those product and services
- The products and services offered by the partners one to another.

Typically the processes operated between partners cover:

1. Concept to Market (aka Service Lifecycle Management)
2. Lead to Cash (aka fulfilment, provisioning and configuration)
3. Trouble to Resolve (aka Assurance, SLA Monitoring and Reporting, Jeopardy Management)
4. Billing and settlements
5. Planning including capacity planning
6. Product / Service Catalog processes: set up taxonomy, add/modify/remove catalog entries, etc.

These processes are realized by orchestrating a series of Business Service requests from one partner to another which may result in a chain of further requests to other partners.

An initial Set of Cloud focussed Quick Start Packs that contain example process flows have been created (see Box)

The Concept to Market Quick Start Pack processes provides end-to-end process flows that are relevant for launching cloud products to the market:

1. Primary C2M Process Flows
    a. Business Opportunity-to-Concept
    b. Concept-to-Business Proposal
    c. Business Proposal-to-Business Approval
    d. BusinessDesign-to-ProductOffering
    e. ProductOffering-to-Launch
5. Auxiliary C2M Process Flows
    f. ServiceDemand-to-ServiceBusinessProposal
    g. ResourceDemand-to-ResourceBusinessProposal
6. Demand-to-Capability Process Flows
    h. SourcingDemand-to-SourcingCapability
    i. SalesDemand-to-SalesCapability
    j. ServiceRequirement-to-ServiceCapability
    k. ResourceRequirement-to-ResourceCapability

QUICK START PACKS (QSP)

Quick Start Packs simplify the application of TM Forum Frameworx suite of standards by providing standard, baseline end-to-end business flows and related activities for specific business scenarios.

The current Quick Start Packs focus on the following:

- GB955 Concept to Market
- GB957 Trouble to Resolve
- GB960 Cloud: Trouble to Resolve
- GB958 Enabling New Services
- GB 949 TV Everywhere on Mobile Devices
- GB959 Fulfilment

Quick Start Guides provide members with targeted "real world" guides on how to use TM Forum standards to address specific business, operations and technical challenges.

This set of processes provide the context for setting up the e2e SLA Management processes for the chosen Business Model which are described in more detail in GB917 SLA Handbook [9].

PRODUCTS AND SERVICES OFFERED

For any business model it is necessary to define the products and services exposed between partners. In common parlance the terms Product and Service are often used interchangeably, the first often being associated with physical things, and the second with intangibles.

Within the TM Forum Frameworx it has been necessary to have a more rigorous definition these terms and those associated with SLAs to underpin these concepts. These formal definitions are in the Information Framework Product and Service addenda [7].

The purpose of these rigorous definitions is to support the representation of multiple types of SLA specifications which are seen in typical Enterprise deployments, whilst also supporting the simpler SLA arrangements seen in Small Medium Enterprise, and retail customer deployments. Moreover these models are important for creating and structuring Product Catalogs, which publish the available products from each partner to others. The structuring of catalogs is sometimes called a taxonomy.

The concepts described here allow for both static and dynamic structuring of catalogs of Products and Services and their supporting SLA specifications. In a cloud world where taxonomies are being proposed by multiple industry groups each covering parts of the cloud service space; and where those taxonomies are in a state of flux; these concepts allow practical agile solutions to be created that can accommodate these inevitable industry changes (dynamic structures), and efficiently capture stable cross industry agreements (static structures).

PRODUCT CONCEPTS

(From Frameworx Distilled) Product is concerned with the lifecycle of product and the information related to the products' lifecycle. It includes the strategic portfolio plans, products offered, product performance, product usage and product instances delivered to customers and partners.

The first pair of definitions needed for SLA Management is related to the specification of two aspects of a Product (taken from Frameworx 12 Information Framework).

ProductOffering represents what is externally presented to the market for the market's use. A ProductOffering can be assembled from a reusable ***ProductSpecification*** (sometimes referred to as a product spec or Product Template). As an example, an email product specification may be used in a number of different ProductOfferings, e.g. one offering may bundle a Broadband Internet offering, while another offering may only have the stand-alone email product.

A ProductOffering is simply a packaging of ProductSpecifications that can be realized by multiple Products, and as such represents what is externally presented to the market for the market's use. A Product is in reality a "procured" instance of a ProductOffering;

SERVICE CONCEPTS FOR SLA MANAGEMENT

The description of Service concepts that follows is restricted to those concepts that are needed to support SLA Agreements. The TM Forum Information Framework [7] has many additional formal service concepts to support other management needs.

(From/based on Frameworx Distilled and truncated) Service Concepts comprises information used to manage the definition, deployment and operational aspects of services provided by an enterprise. They support Business Process Framework Processes. They cover agreements on the deployment and configuration of services, management or problems in service installation, deployment, usage or performance, quality analysis, and service levels to be offered (investigated in the next section.)

(taken from Frameworx 12) The reason Services are linked to Products is that the definition and use of a Product is essential to the business view of the overall TM Forum Frameworx Information model. Customers obtain Products, not Services. Hence, they need to be able to express their needs in plain English in order to determine which ProductOfferings support their requirements.

Likewise, Service Providers and Enterprises need to be able to understand these requirements in order to realize the ProductOffering. Two types of Services are identified:

- A Service that is part of a Product, that is obtained by a Customer – these are called **CustomerFacingService(CFS)** - for example an email service might be seen as part of multiple Product Offering.
- A Service that is indirectly part of a Product, but is invisible to the Customer – it exists to support one or more CustomerFacingServices. These are called **ResourceFacingService (RFS)**. An example is that email services are dependent on Domain Name Services (DNS) and DNS resources may not be explicitly visible to the customer.

A ***Service Specification*** contains entities that define the invariant characteristics and behaviour of both types of Service entities described above. This enables multiple instances to be derived from a single specification entity. In this derivation, each instance will use the invariant characteristics and behaviour defined in its associated template. Sometimes in the cloud community the term ***Service Template*** is used as an alternative to Service Specification to describe this concept of structure for different types of services although in the TM Forum context this alternative term has a different more restricted definition.

A further type of Service Specification entity: that of a ***ServiceLevelSpecification*** is a pre-defined or negotiated set of service level objectives, and consequences that occur, if those objectives are not met. This type of specification creates a template for Services that are bound to a Service Level Agreement.

An example Cloud Service template that has been completed for Database as a Service follows:

Service Template example

Control /Metadata	*Service Specification*	*Simple Data Types*	*QoS*	*Realization*
Service Owner (Business Contact)	Communication Style	Data Type	Minimal Message Size (in Kbytes)	Service Providing Components
IT Service Manager	Short Functional Description	Alpha-numeric	Average Message Size (in Kbytes)	Service Consuming Components
Information Asset Owner	Changed Service Functionality	Boolean	Maximum Message Size (in Kbytes)	Potential Service Consuming Components
Organisational Unit of Owner	Change Backward Compatibility	Characters	Message Size Evaluation	Subscription Lead Time
Domain Architect	Service Preconditions	Currency	Message Transfer Persistence	Cancellation Lead Time
Business Architect	Service Post Conditions	Date	Message Order Relevance	Release Date (General Availability)
Service-ID	Composite Service	Integer	Message Processing Report	Deployment Date (Integration Testing)
Service Short Name	Process Usage	System Time	Message Capture Duration (in days)	Protocol
Full Service Name	Related Services	Time	Message Reporting Place	Gateway
Business Goal	Message/Operation	Timestamp	Data Flow	Service Cost Model
Version	Input Parameters	Number	Maximum Number of Processable Service Messages (per day, per consumer)	Component Design Documentation
Domain	Field/Entity	String	Average Number of Processable Service Messages (per day, per consumer)	Automated Testing
Service Type	<Client>	<Name>	Maximum Number of Processable Service Messages (per second, per consumer)	Development Technology
Process Usage (BPM, Application)	<customer ID>		Average Number of Processable Service Messages (per second, per consumer)	Implementation Dependencies
Annotations & Notes	<customer name>	Complex Data Types Used	Minimum Guaranteed Response Time (in seconds, per consumer)	
WSDL Location	Output Parameters	Name	Maximum Guaranteed Response Time (in seconds, per consumer)	
Business KPI	Field/Entity	<Address>	Operational Availability (time)	
<KPI>	<Client>		Availability (in %)	
<KPI>	<customer address>		Maximum Time of Complete Service Unavailability (in minutes)	
<KPI>	<customer ID>		Data Accuracy (in days)	
	Exceptions		Security	
Change History	<Exception Name>		SLA Regulations	
Action			Source	
Created			SLA Contract	
Updated			SLA Monitoring Metrics	
			Policies	
			<used policy>	
			Daily Throughput Profile	

SLA AGREEMENTS

Linked with the concepts for Product and Service is the notion of a Service Level Agreement (SLA). Essentially this is a specific form of Agreement (which has a specific formal meaning in the TM Forum) that forms part of set of bilateral or multilateral agreements between partners.

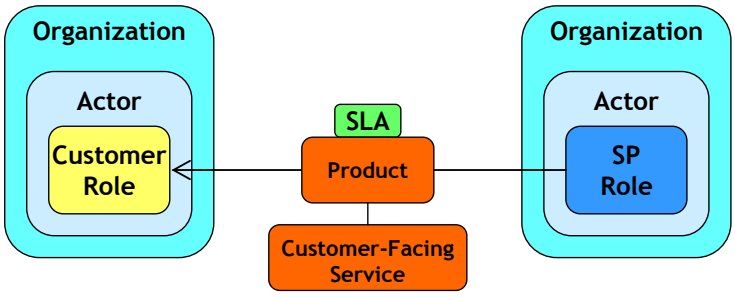


Figure 3 SLA Key Elements *(GB617 r3-1 sec 2.1)*

This simplified view shows two organizations having a commercial agreement where one (SP role) provides a Product to another (customer role). Associated with the specific product is a set of Customer Facing Services sometime called Product Features and a set of SLAs which specify service level objectives, and follow a **Service Level Specification** structure.

SERVICE LEVEL AGREEMENT (SLA)

A Service Level Agreement (SLA) is an element of a formal, negotiated commercial contract between two Organizations, i.e. one with a Service Provider (SP) Role and one a Customer Role. It documents the common understanding of all aspects of the Product and the roles and responsibilities of both Organizations from product ordering to termination. SLAs can include many aspects of a Product, such as performance objectives, customer care procedures, billing arrangements, service provisioning requirements, etc. (***from GB617 v3-1*** *TR178 [8], GB 917 [9]*)

SERVICE LEVEL SPECFICATION

AKA SLA Template, which is associated to a Product, Service or their respective Specifications. Sometimes referred to as a Service Level Agreement Template, a Service Level Specification represents a pre-defined or negotiated set of Service Level Objectives. In addition, certain consequences are associated with not meeting the Service Level Objectives. Service Level Agreements are expressed in terms of Service Level Specifications.

SERVICE TEMPLATE

Aka Service Specification

FROM SINGLE TO MULTIPLE PRODUCTS

This simple model is complicated by the need to ensure the each product, from each partner, does not write its SLA in a totally different way to another. To ensure consistency, SLA information is structured so that different products that have common SLA elements can be captured separately from those that are unique to products, or the Customer Facing Service comprising them.

Without such structures for the specification of Product and Services e.g. Product and Service Templates, SLA Agreements, and **Service Level Specifications**/ templates it is difficult to:

- Capture, manage and express SLA offers in a consistent reusable way across different products and markets
- Create intuitive product and service catalogs that can be easily searched, combined or federated, and the information provided readily understood. This is an important need for e2e services provided by multiple partners.
- Create agile, flexible and robust SLA management solutions and operational processes to deliver those SLA Agreements.

As an example a large number of voice products may have common terms and conditions for supply and have common SLAs for provision and repair. Specifically:

- voice product may have a maximum lead time for supply of say 10 days after which penalties are incurred
- Product help desk responds to requests within a maximum number of seconds and are repaired within a set number of business hours.

These types of SLAs relate to general operations support processes that surround all products. Such common SLAs can be tied to a Master Service Agreement (MSA) that is attached to all Contracts between partners.

Some SLA are related to the overall Product Offering for example an internet package may have an overall SLA covering service availability which is different from voice product family.

MASTER SERVICE AGREEMENT (MSA)

US government National Institution of Standards and Technology suggest that the SLA is part of a "Master Service Agreement" [NIST Contract]. This reflects commercial practice of a Contract between two or more parties being made of a series of documents following standard templates.

The Master Service Agreement (MSA) is a contract between buyers and sellers. It contains considerations of:

- Stakeholders involved in the ecosystem
- Regulatory Compliance, Legal
- Remedy and Compensation
- SLAs
- Other Elements

One of the advantages of a MSA is that contractual Terms and Conditions related to the general business relationship can be separated from Service specific details and conditions, and avoids having unintended differences in the way services are contracted.

Typically, Master Service Agreement will reference documents containing definition of the Services being offered, and separately the SLAs/ SLS for each of those services and possibly the operational aspects. A subtlety that is often missed is that some of the operational aspects of the MSA have SLAs that are common across all services e.g. operational metrics, such as time to repair. These are often captured in a separate business operational SLA distinct from the individual services.

Within the product offering there can be SLAs that are specific to individual customer facing services. For example the minimum bit rate and maximum error rate for Video on Demand can be specified differently from a web access customer facing services /feature.

EXAMPLES OF SERVICE LEVEL AGREEMENTS

The NIST Cloud Computing initiative is managing g a list of commercial SLAs on their wiki. The list is available here.

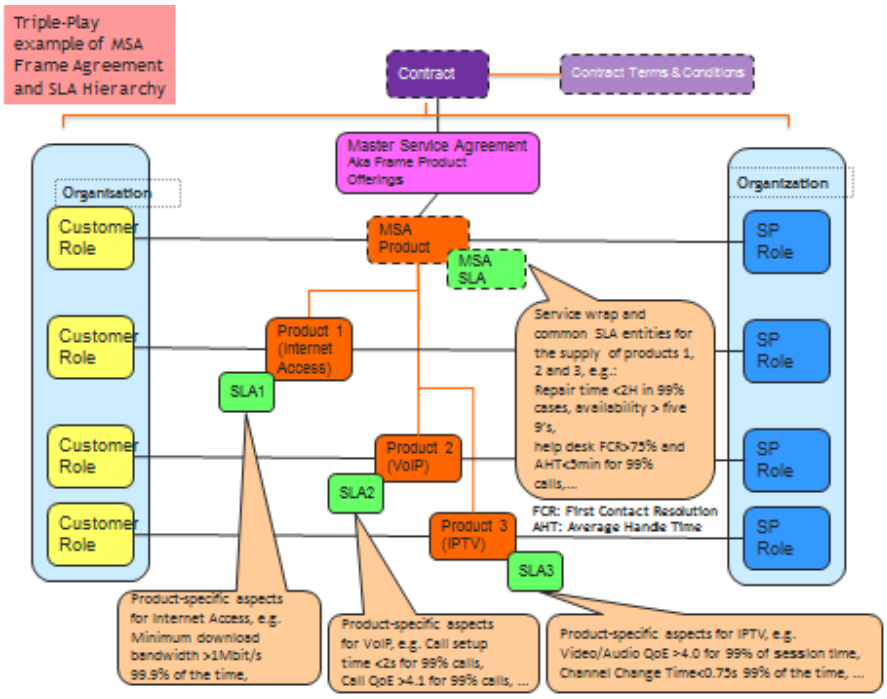


Figure 4 SLA and SLS for multiple products –triple play example *(adapted from GB919 Fig 8)*

In the triple play example shown above:

- The Master Service Level Agreement SLA is applied to a number of Products (1 thru 3).
- The three products are the components of a Triple-Play offer (Internet Access, Voice over IP, IPTV). The Product in this example is associated with a MSA SLA which focuses on “service wrap” as well as common “in-service” aspects, while the actual Product-specific SLAs focus on specific “in-service” aspects.

In all cases each SLA has specific indictors usually called Key Performance indicators with specific values

Associated with all the SLAs are Service Level Specifications (SLS) aka SLA Templates which list the indicators that must be supported and also optional indicators together with their definition and the way in which they must be measured e.g. Thresholds, methods for counting measures, etc.

SLA SERVICE LEVEL TEMPLATE/ SERVICE LEVEL SPECIFICATION RELATIONSHIP

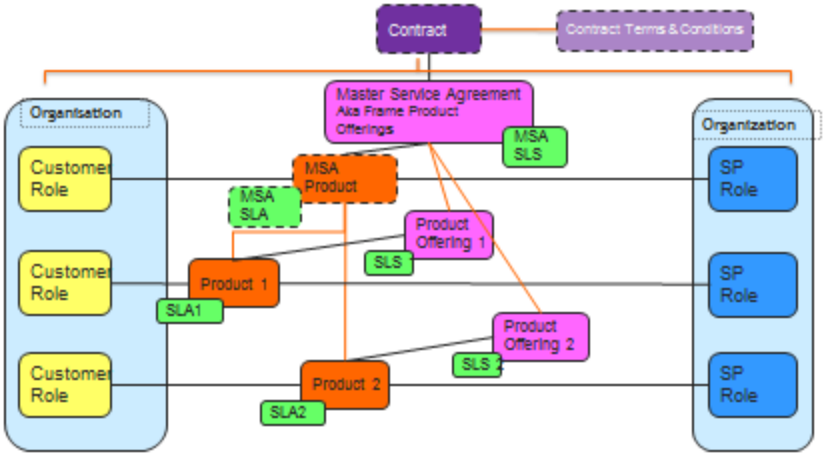


Figure 5 Relationship between SLA and SLS

This diagram shows that the SLA for Products that are within a Master Service Agreement are based on a MSA Service Level Specification template and that individual products within the MSA Product "frame" may have addition Product specific SLAs based on Product SLS.

Similarly but not shown the Customer Facing Service making up the products may have additional SLA components added to them which may be common for all products using those services e.g. Internet access service SLAs may apply to Triple play and email products, and hosted application . These are also based on SLS templates.

More extensive description of these concepts is in the GB917 Service Level Agreement Handbook Rel3-1 [9].

KEY BENEFITS

By structuring both product and service SLAs and SLS as described it is possible to:

- Create consistent SLAs for all aspect of products.
- Reuse SLA structures across many products thus allowing operational targets to be decoupled from individual products, and makes reuse of services from multiple partner straightforward and agile.
- Consistently structure the SLA information about product and service in catalogs that are used amongst partners. This makes the setup of commercial arrangement and their operation a matter of assembling well defined piece parts rather than creating bespoke business arrangements.

These concepts help industrialise the realisation of partner business models, and value chains from both a Product/Service and SLA Management perspective.

MULTI-PARTNER SLA ARRAGEMENTS

Thus far the emphasis has been on the structuring of SLA for product provided between a pair of partners. For end to end SLA Management across values chains additional concepts are needed, and have been studied in:

- GB963 Cloud SLA Application Note [10] which applies the general TM Forum SLA Handbook concepts to cloud examples covering PaaS, IaaS, and SaaS. The scenarios considered include: Gaming;

Enterprise Application development and testing; and leveraging SP data collection capabilities to creating a single customer bill and measuring service availability, usage, trending, digital advertising and billing.

- TR 178 Enabling End-to-End Cloud SLA Management [8] which pulls together more technical concepts and solutions for multi-partner SLA challenges. It is the technical companion to this document.

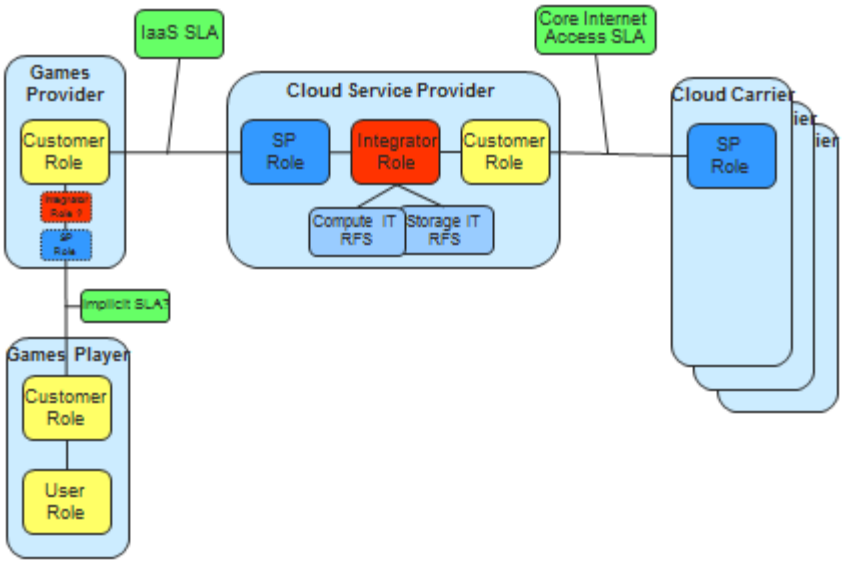


Figure 6 Multi cloud Multi partner games example – *(simplified view from GB963)*

In this scenario a games company created a new game hosted internally and the tremendous success has caused some customer experience issues related to latency. The company needs to quickly procure additional compute capacity, to improve performance and optimize customer experience. The decision was made to have this particular game hosted externally, by a Cloud Service Provider under a "public" cloud deployment model. The interactive nature of the game requires that the Cloud Carrier and Cloud Service Provider collaborate to establish a level of service that satisfies the business expectations: to increase the number of concurrent players from 10,000 to 100,000 without negatively impacting the player experience.

In this environment a few additional concept emerge:

- **SLA Integration** The Cloud Service Provider has to integrate the SLA provided by the Cloud Carrier with its own SLAs to create a single SLA for the Games Provider. The integration of SLA metrics from different types of service is not trivial and discussed further in TR 178 [8].
- **Implicit SLAs** The Games Provider creates an implicit SLA with the games player which is managed by the Games Provider setting internal SLA targets sometimes called Operational Level Agreement (OLA) that it uses as if they were part of SLA agreement formally contracted with the games player. The Games Provider does this because it knows from experience with latency that the Game Player has view of what acceptable means, and if this is not delivered they will either complain or change providers all of which have cost and revenue implications for the Games Provider.

When constructing multi-cloud solutions, new organization roles can emerge which are about managing relationships between the Core Partners, and to provide auxiliary business support functions such as Security (Identity management), brokering to match buyer and sellers (which requires catalog capabilities), and roles such a third party SLA Auditor.

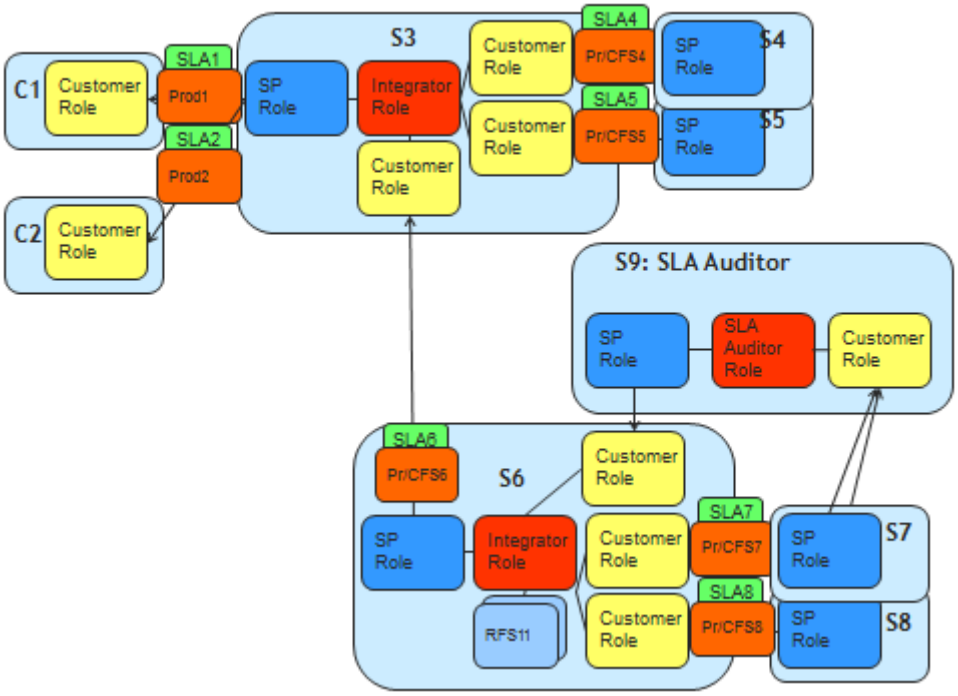


Figure 7 Multi-cloud Partner example with additional partner roles *(adapted from TR 178 Fig 4)*

This figure adapted from TR 178 Enabling End-to-End Cloud SLA Management [8] shows two additional specialized integration roles.

- Organization S3 acts as **Service Broker** between the Customers (C1 and C2) and the organisation that have real resources to support the end to end service. S3's only resources are the agreements it has with S4, S5 and S6. S6 is also a broker but it does have real resources (RFS). In the case of S3 the service broker integration function includes mapping the SLAs from S4, S5 and S6 into the SLAs it has with C1 and C2.
- In the case of S6 it has delegated the integration role for SLA mapping to a separate partner S9 **SLA Auditor**[1] that combines the SLA measures from S7 and S8 and S6 to provide the SLA monitoring capability for SLA 6. The emergence of such roles is highly probably because the mapping of several SLA into an overall SLA is complex and requires heuristics on how technical measures impact perceived quality by the customer. The next section on metrics provides an overview of this complexity.

KQI
In an SLA context, a metric meaningful to the Customer.
KPI
In an SLA context, a metric meaningful to the Service Provider.

METRICS AND KEY PERFORMANCE INDICATORS

The TM Forum distinguishes between Key Quality Indicators and Key Performance Indicators. Key Quality Indicators (KQIs) provide a measurement of a specific aspect of the performance of the product, and draw their data from a number of sources including the Key Performance Indicators (KPIs). Key Quality Indicators are usually associated with Customer Experience, and perception of quality, whereas Key Performance indicators

[1] NIST has identified an Auditor role that addresses needs of finance and legal governance, and auditing. This role can be associated with a Service Broker. Similarly a SLA Auditor role can be associated with a Service Broker organisation.

are usually based on technical based measures. KQIs can be derived from KPIs using heuristic or subjectively derived relationships. The neutral term 'measure' is used to describe them both.

All SLAs are made up of metrics or indicators that are defined in a Service Level Specification or template associated with them. So the next question is where can one find list of these Indicators and how do they work?

The SLA Handbook describes the general lifecycle model for identifying and defining measures. The SLA Handbook may be referred to for further detail in defining SLAs beyond what is covered in this document. It specifically addresses:

- The general lifecycle model for developing SLAs and the metrics used by them
- SLA for management Business Process Flows e.g. Product SLA Process Flows
- Customer/Supplier SLA Lifecycle e.g. Create/Modify Customer/Supplier SLA
- Process Flows for Supplier/Customer Interactions e.g. SLA Specification and Negotiation
- Metric definition template (Annex C1)
- SLA template (Annex C2)

For Digital Services and Cloud GB963 Cloud SLA Application Note Section 5.3 [10] extends the SLA Handbook by defining a set of KQIs covering *Flexibility Availability Management, Performance Management, Change Management, Incident Management, Problem Management, Continuity Management*; and examples are developed for three scenarios. TR 178 Table 3 [8] has taken those examples, and identified the most important KPIs for Digital Services and Cloud - shown below.

Category	Important Characteristics	Important KQIs
Flexibility	Scalability	Time to Provision New Service Increment Time to Adjust Existing Service Increment
Availability Management	Availability	Time available/total time x 100% per period
Performance Management	Performance Quality Capacity	Performance of defined transaction Conformance to documented requirements Load Testing
Change Management	Conformance of Change to Plan Testing	% rollbacks % of failures
Incident Management	Monitoring	Elapsed time by status and priority Maximum # of incidents by type/period
Problem Management	Ability to provide adequate data & communications about problems	Time to resolve problem, status updates % of jeopardy vs. incident notices by type (Availability, Capacity, Security, Penalties)
Continuity Management	Low Downtime Maintenance Disaster Recovery Data Protection	Number and frequency of backups Time to recover Loss of Data

It might seem that these metrics are quite vague, but the use of the Metric Template, introduced as part of the TM Forum GB935, Business Benchmarking Metrics Scaffold [11], and as used in the SLA Handbook, introduces the level of rigor necessary to create repeatable measures across industry partners that can be compared and used as the basis of business decisions. The Scaffold spread sheet BM1000 [12] has around 100 metrics based on the Metrics Templates that cover Customer Experience / KQI/KPI, Operational Efficiency, and Revenue and Margin aspects. They are supported by a formal benchmarking program supported by about 150 service providers. An example of the use of the Metrics template from the SLA Handbook (GB917) is shown below.

EXAMPLE VIDEO ON DEMAND METRIC

Metric ID	
Topic	Quality
Purpose	Measure of video quality in an IPTV service
Metric	Percentage of session time with MOS-V < n
Detail	1. By Customer 2. By Network Access point 3. By Distribution Node. Note: value of 'n' to be determined. Two values of 'n' could be used, one for severe quality problems, one for less severe but service impacting quality problems. Note: Aggregation method and location of measurement point need to be
Units	Percentage 2DP
Capture Period	Hour/Day/Week/Month
Preferred	Low
Numerator Description	Session time with MOS-V less than 'n'
Numerator includes	number of measurement windows with MOS-V < n x duration of measurement windows; measurement window should be less than x seconds where x = 15 seconds
Numerator excludes	measurement windows outside total session time (see below)
Numerator units	Seconds
Denominator Description	Total session time
Denominator includes	Time from first media packet received to time of last media packet
Denominator excludes	Time before video stream starts but stream has been requested by customer
Denominator units	Seconds
Comments	
Question:	What is the percentage of IPTV session time with Quality (expressed as MOS-V) below the acceptable threshold?

THRESHOLDS, JEOPARDY MANAGEMENT, AND REMEDIES

In practical SLA Management situations the establishment of Metrics needs to be augmented by agreeing on thresholds for those metrics between parties at which alerts will be sent to the customer that the SLA is in Jeopardy, and also when the SLA has been violated. The determination of these thresholds and the remedies is something that can be captured in Master Service Agreement and Service Level Specifications aka SLA Agreement Templates. The processes and steps for these are described in GB917 SLA Handbook [10] sections 3.2.4 Develop Product SLA Specification, and 3.3. SLA Management, along with check lists and best practice guidance.

KEY BENEFITS

The use of the metrics templates and the procedures outlined in GB935[11] and BM1000 [12] [13] will ensure that metrics used for monitoring digital services and cloud are repeatable, can be exchanged between partners with the knowledge that they are accurate and comparable whichever partner originates them. Without this rigorous approach it is known that Metrics from different tools and organisations cannot be readily compared and used as the basis of commercial decisions, such as determining SLA violations and entitlement to remedies.

These are important, practical and significant commercial challenges for running complex value chains to support digital services. Furthermore the TM Forum Benchmarking Program has proven that this approach to metrics does work in real world operational contexts.

BUSINESS BENCHMARKING

TM Forum Business Benchmarking Program's performance data to:

- Facilitate business decision-making
- Track business performance against best-in-class peers worldwide

Benchmarking is based on the comprehensive set of Business Metrics defined in Frameworx.

GB935, BUSINESS BENCHMARKING METRICS SCAFFOLD

This document described the concepts for Business Metrics that have been used, and the metrics themselves. They represent areas of business operation that are important in assessing business performance, customer satisfaction/loyalty and efficiency.

BM1000 BUSINESS PERFORMANCE MEASUREMENT SYSTEM

This contains all the detailed metrics, the rules for using them and the templates used to capture specific metric information. The emphasis is on management metrics rather than service specific metrics.

OTHER SOURCES OF CLOUD DIGITAL SERVICE METRICS

There are some outline metrics proposed by ETSI for communication services that might be realised over the cloud here.

END TO END PROCESS AND CHECKLISTS

Leaving the discussion of concepts behind Multi-cloud e2e SLA Management, we now turn to practical guidelines and checklists for the SLA lifecycles needed to support the establishment and operation of SLA agreements between partners in a digital services value chain . Many of the detailed SLA processes are available in GB917 [10] and TR 178 [8] and reference to the relevant sections are included in the descriptions below. The following sections are intended to be a simple approach to checking that all the important matters have been decided at the close of each PaDIOM stage.

PARTNERING

KEY OUTCOMES

Effective partnering needs all partners to have a clear understanding of what they are providing to whom and the rewards, risks, and remedies. This stage focuses on collecting all the business information, policies and rules that need to be agreed prior to the detailed design stage.

CHECK LIST

Checklist Item	Evaluation
Business Model	Has a business model been constructed using the CANVAS method, or equivalent? Have ALL the partners, and their multiple roles, been captured in the business model? *Note this includes Service Broker, other intermediaries, agents and those providing shared services like security, auditing billing and settlement services*. Have the business rules and policies for operating the chosen Business Model been identified and documented? *Note: the focus is on SLA rules policies and remedies.*
E2e and inter-partner Processes	Have the e2e processes amongst partners been identified /listed, covering both automated and manual e2e SLA Management processes? *Note The detailed design of the e2e processes forms part of the Design stage. This stage identifies and scopes the e2e processes. The focus in this Blueprint is on the processes for agreeing, configuring, monitoring and reporting SLA Performance.* For the listed e2e SLA Processes, have the partners and their roles been identified and documented. *Note this is to check which partners are involved in which e2e processes and to identify if there are missing partners roles.* Have all the processes between the partners necessary to support e2e SLA processes been identified, both automated and manually operated? *Note Consider which of these process may be relevant* • *Concept to Market (aka Service Lifecycle Management)* • *Lead to Cash (aka fulfillment, provisioning and configuration)* • *Trouble to Resolve (aka Assurance, SLA Monitoring and Reporting, Jeopardy Management)* • *Billing and settlements* • *Planning including capacity planning* • *Product / service Catalog process Access, Updates, add/remove catalog entry.*
Products and SLA	In the Business Model have the products and services, and their associated SLAs provided by each partner, been identified?

templates	*Note The processes in GB917:* *3.2.2 Product SLA Business Process Decomposition* *3.2.3 Define Product SLA Strategy* *3.2.4 Develop Product SLA Specification* *Can help with this analysis.*

EXIT CHECK LIST

1. Business model completed, documented, and agreed by all partners.
2. High level e2e SLA Processes listed and relationship to each partner role the e2e process documented.
3. Partner Products and services offered by partners identified, listed and the key functions identified along with a business level view of SLAs offered.

DESIGN (BUSINESS LEVEL):

KEY OUTCOMES

A complete design, including agreed set of e2e processes, that support the e2e SLA processes agreed in the chosen Business Model; and complete specifications of what each partner has to deliver into the business model covering the functional and SLA management capabilities.

CHECK LIST

Checklist Item	Evaluation
Detailed B2B operational processes (Flows)	Have the e2e End processes identified in the 'Partner' stage been designed down to the level such that specific process steps in the e2e Processes can be associated with specific partners and roles? *Note this is an analysis to check that what is being offered by Partners matches the needs of the e2e processes when orchestrated across partners within the chosen value chain streams and business model.* *The SLA processes described in GB917 [9] sections give a comprehensive starter set for SLA processes and the process stages. These can be used and adapted to the specific partner arrangement in the agreed Business Model. The relevant processes for digital services are:* *3.2.1 Product SLA Process Flows* *3.2.1.1 Service Provider Offering Standard Product with Standard SLA* *3.2.1.3 Buying Product (Standard or Special)* *3.2.2 Product SLA Business Process Decomposition* *3.2.3 Define Product SLA Strategy* *3.2.4 Develop Product SLA Specification* *3.2.5 Launch Product SLA* *3.2.6 Handover Product SLA* *3.2.7 Sell/Buy Product SLA* *3.2.8 Product SLA Operate1* *3.2.9 Assess Product SLA Operations* *3.2.10 Assess Product SLA1* *3.2.11 Retire Product SLA* *3.3 Customer/Supplier SLA Lifecycle* *3.3.1 Create/Modify Customer/Supplier* *3.3.2 SLA Management* *3.3.3 Supplier SLA Management Processes and Flows* *3.3.4 Terminate Customer/Supplier SLA* *3.4 Process Flows for Supplier/Customer Interactions 88* *3.4.1 SLA Specification and Negotiation 88* *3.4.2 SLA Management Interactions* Have the partners and their roles in the e2e SLA Process been identified and associated with specific process steps and documented? *Note e2e process is broken down into process steps distributed across 'swimlanes' where each partner and their roles should be associated with a 'swimlane' containing all the process steps for which they are responsible.* Have all the processes between the partners been identified, both automated and manually operated? *Note: Some of the e2e SLA Processes have dependencies on other process such as configuration and repair between partners. This question checks that these dependencies have been captured in the design phase.*
Example Templates for defining	Has an agreed SLA Template (SLS) been agreed amongst the partner

SLAs	design team? *Note This template is needed for consistent catalogs to be created which can be federated amongst the Partners.* *Review and adapt the SLA template (SLS) examples described earlier.*
Example Templates for defining Service	Has an agreed Service Template (Service Specification) been agreed amongst the partner design team? *Note This template is needed for consistent catalogs to be created which can be federated amongst the Partners* *Review and adapt the Service Template example described earlier.*
Product and service design and definitions	Have the Partner Products and Services been documented using a Product and Service Template (specification) to the level of detail necessary to formally record all the information in a product catalog; so that the buyer by referring the catalog can determine what Products and their associated SLAs are offered by a partner? *Note the example Service Template/Specification and the SLA Template (SLS) can be used to record the specific information for each Product and Service. However the partner has to structure this information into Master Service Agreements; and specific Product and Service relationships.*
KPI (metrics) library	Have the partners agreed a library of metrics to be used in the SLA Templates? *Note: These metrics should be based on the BM1000 metrics template illustrated earlier and specific metrics should be drawn from TM Forum (TR 178, GB963, GB917, BM1001) and other standards sources.*
Product/ Cloud Service Catalog supported by Service Template and taxonomy	Has each partner documented each of products and services that they will supply using the Service and SLA templates agreed, together with an agreed structure for the relationships between MSA, Product and service template? Have these been capture in a common catalog structure and format? *Note: May be electronic or paper based.* *These templates and structures are needed to create the catalog taxonomy.*

EXIT CHECK LIST

1. Compete e2e SLA Management Process design where each partner has:
   - Clear roles and responsibilities in those e2e processes,
   - Defined product and services that they should deliver.
2. Defined SLA and KPI Metrics for the products that Partners deliver.
3. Partner Products and Services with associated MSA and Product and Service definitions, completed to a common catalog standard used across all the partners.

INTEGRATE

KEY OUTCOMES

The primary focus of this phase is the technical integration of the partners into a value chain to support the chosen business model. From a business view point there are a few checks needed to ensure that the solution developed meets the business requirements.

CHECK LIST

Checklist Item	Evaluation
E2e instrumentation of cloud service for incidents and management reports. **Simple Management API (SM-API)**	Are the individual cloud products and services manageable and instrumented in a consistent e2e manner? *Note When problems/incidents occur with the value chain or where management statistics need to be collected, it is necessity to have a consistent instrumentation strategy for all of the cloud Product and Services used in the values chain.* *TM Forum has specified the Simple Management API (SM-API) [14] for instrumenting Cloud services e2e based on a TMF061 SES Reference Architecture .[15] The use of the SM-API for metrics collection to support SLA management is explained in detail in the Technical Guide [17] and the Developer Pack [18].*
Business aspects of Integration strategy	Has the Developer community proposed an integration strategy for all the Cloud services within the Value Chain? Has this been validated for cost, security, agility and scalability?

EXIT CHECK LIST

1. Documented development strategy for a consistent e2e management of the cloud product and services provided by the partners covering at least incident management and management Reporting.
2. Documented implementation proposal for an integration solution covering: cost, security, agility (for adjusting to business model evolution), and demonstration of operation at the intended business scale (transaction volume, customer numbers, etc.)

OPERATE

KEY OUTCOMES

The goal is to demonstrate that the partners are operationally ready to deliver the e2e Services and manage the e2e SLAs.

CHECK LIST

Checklist Item	Evaluation
Operational Implementation	Has the operational and organizational structure required by all partners collectively, and individually, been documented? *Note: Roll out of a solution needs each partner to have planned how its organization will support their part to the end to end solution, and for each partner to provide evidence that this has been done.*
Operational Readiness	Have the partners rolled out their internal organization and procedures for the business model, and tested them? *Note: This process, called Operational Readiness by the TM Forum, ensures that the organization is prepared to operate there part of the e2e processes. For systems this includes setting up necessary user and administration accounts and training staff to use the systems. For manual process it needs work instructions written and staff training.*

	A formal test of these processes and procedures is needed before the service goes live. For example is often forgotten that contact numbers need to have been agreed, set-up, and tested so that when they are called that they are answered by trained staff.
Agreed management stats, KPIs summaries. Template	Have the structure and content of management reports, and the KPIs within them, been agreed amongst partners? *Note Business benchmarking metrics [11] especially those related to Customer Experiences can be useful in proposing management report KQI/KQIs.* *SLA Handbook processes below can be helpful here:* *3.2.6 Handover Product SLA* *3.2.7 Sell/Buy Product SLA* *3.2.8 Product SLA Operate1* *3.2.9 Assess Product SLA Operations* *3.2.10 Assess Product SLA1*

EXIT CHECK LIST

1. Documented evidence that each partner has put in place the necessary organization, processes systems and training to operate their cloud products and services as part of the e2e multi-cloud SLA processes.
2. Documented evidence that the organization has operationally tested their internal support arrangements.
3. Documents recording the partner agreements on management reports, their structure, the KQI/KPI used, the way they are aggregated, and the frequency with which they are reported.

MONETIZE, SLA GUARANTEES, REBATES

KEY OUTCOMES

Demonstrate that operational agreements and experience of practical day to day operation of the SLAs Guarantees and rebates actually work. Improved cloud operational service maturity levels.

CHECK LIST

Checklist Item	Evaluation
Operational readiness: **Settlement and rebate processes**	Have the partners rehearsed the processes for reporting on SLA, analyzing the SLA Management Reports to determine violation and impairments, and operated the rebating process? *Note: It is one thing to run these processes in a trial operational readiness context but it is another to do this when real customers and real rebates are being discussed as these involve parts of organization that are usually are only peripherally involved in setting up the e2e cloud services e.g. Finance.* *The SLA Handbook give basic processes to handle rebating* *3.2.9 Assess Product SLA Operations* *It is usually necessary to refine and localize these processes to codify the exact procedures*

	for determining when SLA violations have occurred and to authorize and track the rebates. *The earlier this process is addressed the better as inadequately defined rebate process with large sums of money involved creates a toxic business situation.*
Product and service defined	Have the partners formally reviewed the Cloud Product and Service definition and SLAs in the light of actual settlement and rebate rehearsal results? *Note The quicker operational experience is fed back into the original Cloud Product and Service specification and associated SLA s the quicker the partner can move to an effective and stable e2e SLA management condition. i.e. improve the maturity of the cloud solution.*

EXIT CHECK LIST

1. Documented SLA violation and rebate process rehearsal based on live service.
2. Evidence of improved Cloud Product and service definitions and associated SLA specifications, i.e. improved Cloud Service Maturity though up date of original cloud Product and SLA specifications.

SUMMARY OF E2E SLA MANAGEMENT BENEFITS

In this Blueprint we have presented the key concepts developed within the Forum for modelling Service Level Agreements and how they apply to Multi-cloud partner deployments. It illustrates how these concepts can be applied to different Business models using NIST Cloud Scenarios as examples.

These have been set in the context of broader activities concerned with establishing process agreements between cloud partner, the use of TM Forum processes in Quick Start Packs and the Business process framework, and the SLA Handbook

A straightforward step by step check list for establishing and operating SLA agreements in a Multi cloud context has been presented which is derived from the SLA Handbook and other related TM Forum Sources. This makes it easier for the user to apply relevant best practice consistently, rather than the user having to research all available relevant sources themselves.

REFERENCES

All references have hyperlinks to their sources; some links require the user to have a TM Forum Member account.

[1] TR174 Enterprise-Grade External Compute IaaS Requirements

[2] TR174-A Cloud Business Models

[3] TR174-B TM Forum Enterprise-Grade External Compute IaaS Requirements

[4] Canvas, Alexander Osterwalder

[5] Cloud Computing Reference Architecture
NIST Cloud Computing Reference Architecture (NIST SP 500-292)

[6] GB955 Quick Start Pack: Concept-to-market (C2M)

[7] GB922 Information Framework Rel 12 - Product and Service Addenda

[8] TR 178 Enabling End-to-End Cloud SLA Management

[9] GB917 SLA Management Handbook Release 3.1 Version 1.1

[10] GB963 Cloud SLA Application Note Version 1.1

[11] GB935, Business Benchmarking Metrics Scaffold, Release 6.0

[12] Business Metrics Solution Suite, Release 1.0

[12] BM1000 Business Performance Measurement System

[13] BM1001 Business Performance Metrics Development Guide

[14] TMF 617 SES SMI Specifications

[15] TMF061 Software enabled Services Reference Architecture

[16] Willetts, K. (2012). Unzipping the Digital World. Morristown, NJ: TM Forum.

[17] TR196 Multi Cloud Service Management Pack Technical Guide

[18] Multi Cloud Service Management - Developer Pack

3 ADMINISTRATIVE APPENDIX

This Appendix provides additional background material about this document.

VERSION HISTORY

<This section records the changes between this and the previous document version as it is edited by the team concerned. Note: this is an incremental number which does not have to match the release number>

Version Number	Date Modified	Modified by:	Description of changes
0.1	5th October	Dave Milham	Editor draft
0.2	9th October	Dave Milham	Includes review comment Rebecca Sendel(RS)
0.3	11th Oct	Dave Milham	Most RS changes accepted, comments left in, added summary. Baseline version for review.
0.4	21st Oct	Dave Milham`	Review for flow, length of sections and typos. New Baseline version for review.
0.5	23rd Nov	Dave Milham	Changed document title and references throughout the text. Baseline for review
0.6	13th Nov	Dave Milham	Adjust Auditor to address comments received JSH
0.7	21 Nov. 12	TM Forum Staff	format adjustment and other minor corrections.
0.8	21 Nov. 12	Joann O'Brien	
0.9	21 Nov. 12	TM Forum Staff	updated with new notice statement
1.0	26 Nov. 12	TM Forum Staff	Removed R1.0 from cover, typos, updated ToC
1.1	22 Feb. 13	John Wilmes	Updated content, updated ToC
1.2	25 Feb. 13	TM Forum Staff	Fixed hyperlinks and addressed other cosmetic fixes.
1.3	27 Feb. 13	TM Forum Staff	Minor cosmetic fixes prior to web posting

RELEASE HISTORY

Release Number	Date Modified	Modified by:	Description of changes
R1.0	05/OCT/12	Dave Milham	First issue of document
R1.5	28/FEB/13	John Wilmes	Second issue of document

ACKNOWLEDGMENTS

This document was prepared by the following people:

- Authors: Keith Willetts, David Milham, Marco Giaccaglini *TM Forum*
- Editor: David Milham, John Wilmes *TM Forum*
- Reviewers and contributors:
  - Rebecca Sendel
  - Joann O'Brien
  - Marco Giaccaglini
  - Hugo Vaughan
  - Jenny Huang, AT&T
  - Victor Havard, IBM
  - Laurent Philippart, Alcatel-Lucent
  - Gerald Damm Alcatel-Lucent
  - Greg Bain, National Communication System
  - John Timms, Telchemy
  - Ron Roman, Applied Communication Sciences
  - John Deheus, Ericsson
  - Antonio Cruz, Portugal Telecom
  - Ian Best, Eyelbe
  - Mohammed Abdulaziz Alhakbani, STC

