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Foreword

This Technical Report (TR) has been produced by ETSI User Group (USER).

Modal verbs terminology

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Introduction

Nowadays, the user is at the centre of the architecture. He has access to any service, from any network and by any means, from anywhere, all the time.

1 Scope

The experience of the "Covid-19" recently faced has played a role of accelerating and making users enter definitively into "the digital era".

On the user side, this meant that in their daily life teleworking, online shopping and a lot of vital and key information was shared through online social networks. Considering the needed digital services, often used for the first time, the user became aware of the importance of quality of service and the many factors which contribute to it.

On the supplier side, the role of digital transformation manager was created, directly linked to general management.

Among the new paradigms, the "As-a-Service" is the main driver to support digital transformation. The user wishes to obtain a personalized service whatever the place they are and whatever their means of access with the corresponding QoS. The user expects this is also provided "As-a-Service", meeting their needs and not a "best effort" delivery.

The present document proposes a new approach to implement a QoS adapted to the digital ecosystem, with both views from the user side and from the supplier side.

2 References

2.1 Normative references

Normative references are not applicable in the present document.

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] ETSI TS 102 827 (V1.1.1) (2008-08): "GRID; Grid Component Model (GCM); GCM Interoperability Deployment".

[i.2] ETSI TS 102 828 (V2.1.1) (2010-03): "GRID; Grid Component Model (GCM); GCM Application Description".

[i.3] ETSI TS 102 829 (V1.1.1) (2009-03): "GRID; Grid Component Model (GCM); GCM Fractal Architecture Description Language (ADL)".

[i.4] ETSI EG 202 009-1 (V1.3.1) (2014-12): "User Group; Quality of telecom services; Part 1: Methodology for identification of indicators relevant to the Users".

[i.5] ETSI EG 202 009-3 (V1.3.1) (2015-07): "User Group; Quality of ICT services; Part 3: Template for Service Level Agreements (SLA)".

[i.6] IETF RFC 2617: "HTTP Authentication: Basic and Digest Access Authentication".

[i.7] Lloyd V. ITIL Continual Service Improvement: "The Stationery Office (TSO)". 23 Aug 2011. ISBN: 9780113313143.

[i.8] ISO/IEC 20000-1:2018: "Information technology -- Service management -- Part 1: Service management system requirements".

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the following terms apply:

InMonitor: component that intercepts incoming service, stores the non-functional information about the requests, which are then transmitted (unchanged) to the functional component, via the corresponding internal interfaces

micro-service: basic and simple service (with SoA properties) that be combined for the composition of services as expected by the User

NOTE: The basic concept behind this term is that each service performs a unique feature (e.g. for security, "authentication" is a micro-service, for discovery, "find" is a micro-service).

OutMonitor: component that intercepts and stores outgoing service requests

profile: information template (model) to provide or to access to personalized services

QoSControl: component that makes the necessary metric analysis and calculations to evaluate the behaviour of the service component and its conformity with the contract

quality of service: ability of a service to respond by its characteristics to the different needs of its users or consumers (AFNOR)

service: immaterial performance that can be composed, manifestly displayed and which, in a pre-defined condition of use, is a source of value for the consumer and the supplier (ISO/IEC 20000-1 [i.8])

3.2 Symbols

For the purposes of the present document, the following symbols apply:

InMonitor	Input Monitor
OutMonitor	Output Monitor
QoSControl	Control of the QoS

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

API	Application Program Interface
CPU	Central Processing Unit
FCAPS	Fault, Configuration, Accounting, Performance, Security
GCM	Grid Component Model
GDPR	General Data Protection Regulation
HMI	Human Machine Interface
ICT	Information & Communication Technology
IMS	IP Multimedia Subsystem
IoT	Internet of Things
ISO	International Organization for Standardization
ITIL	Information Technology Infrastructure Library
LED	Light Emitting Device
OpenIMS	Open Infrastructure Management System
QoE	Quality of Experience
QoS	Quality of Service
RAM	Random Access Memory
SLA	Service Level Agreement
SLO	Service Level Objective
SOA	Service-Oriented Architecture
TTM	Time To Market

IT	Information Technology
IP	Internet Protocol
IS	Information Systems

4 User in a digital ecosystem

4.0 New user provisioning approach

In a digital ecosystem the provisioning of a wide range of services depends on the orchestration of heterogeneous, distributed software components, which can be owned by different service providers and operate over diverse networks. In such a context, designing and providing value-added services, ensuring their nominal quality levels with service deployment, provisioning, monitoring and management becomes increasingly difficult. Provider resources are shared by all clients. In the cloud computing context, the outsourcing introduces the need of Service Level Agreement (SLA). How the mapping between the user demand and the provider supply can be performed?

To answer this problem, the proposed new approach aims to express the user requirements and the provided services with the same model. The main advantages of this approach are the modelling and the overall management of digital ecosystem behaviour founded on a new integrated service component that distinguishes itself through a "self-control" property based on QoS and the "As-a-Service" concept.

4.1 User profile

A good digital user experience is based on always online services, easily accessible anytime and everywhere, on demand, in real-time, and available in self-service along with a fast helpdesk service response. For the user, that means a good level of flexibility and control of his digital environment.

In a digital ecosystem the user, according to his level of experience:

- gets the service automatically; or
- makes his choice in the catalogue for a composition of service according to the QoS requested.

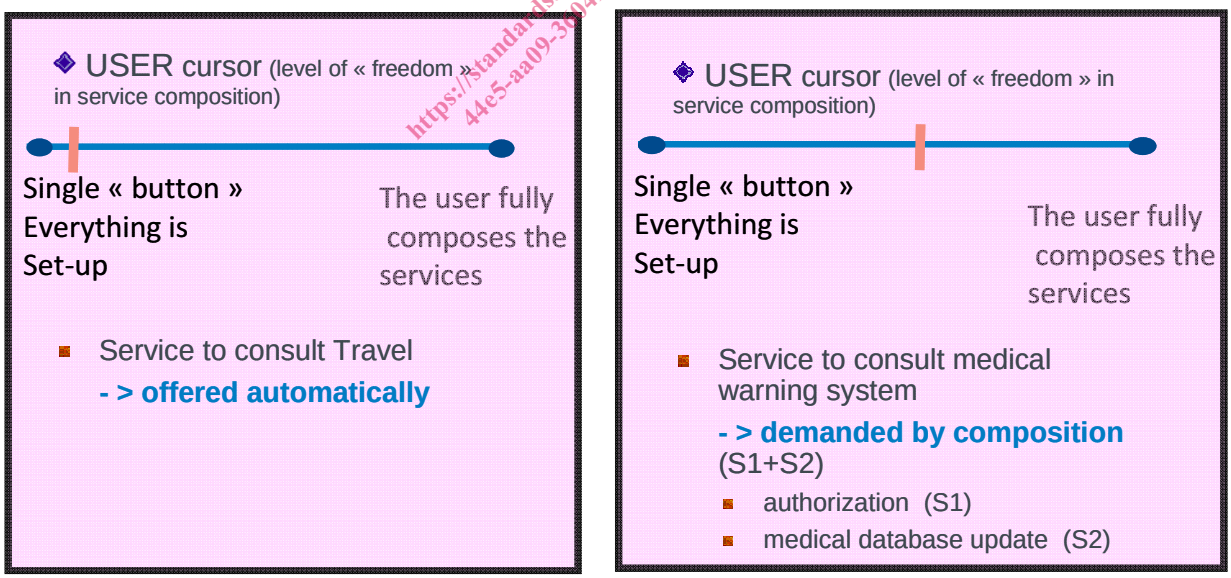

Figure 1: User profile

In this context the user services composition can be based on setting, user profile, HMI, QoE and the degree of service security (authentication, authorization, confidentiality, cryptography, etc.).

The user profile provides the image of the user defining the user's preference, possibilities and constraints, in a structured and uniform format. This profile provides an easy access to all necessary data and relevant selection of each service component according to the user's preference. Each service composition proposed by the provider should be linked to a user service session.

4.2 Requirements: Service Level Agreement (SLA)

A Service Level Agreement (SLA) is an agreement formally negotiated between two parties.

The SLA serves as a means to formally documenting the service(s), performance expectations, responsibilities and borders between cloud service providers and their users. It aims to managing service quality through the customer experience life cycle. This means managing service quality beyond the in-use phase of the life cycle to include sales, provisioning, in-use phase and service termination aspects.

The objective of the end-to-end QoS is to build and maintain the adequate service over a dedicated user session while respecting SLA and QoS constraints (Figure 2).

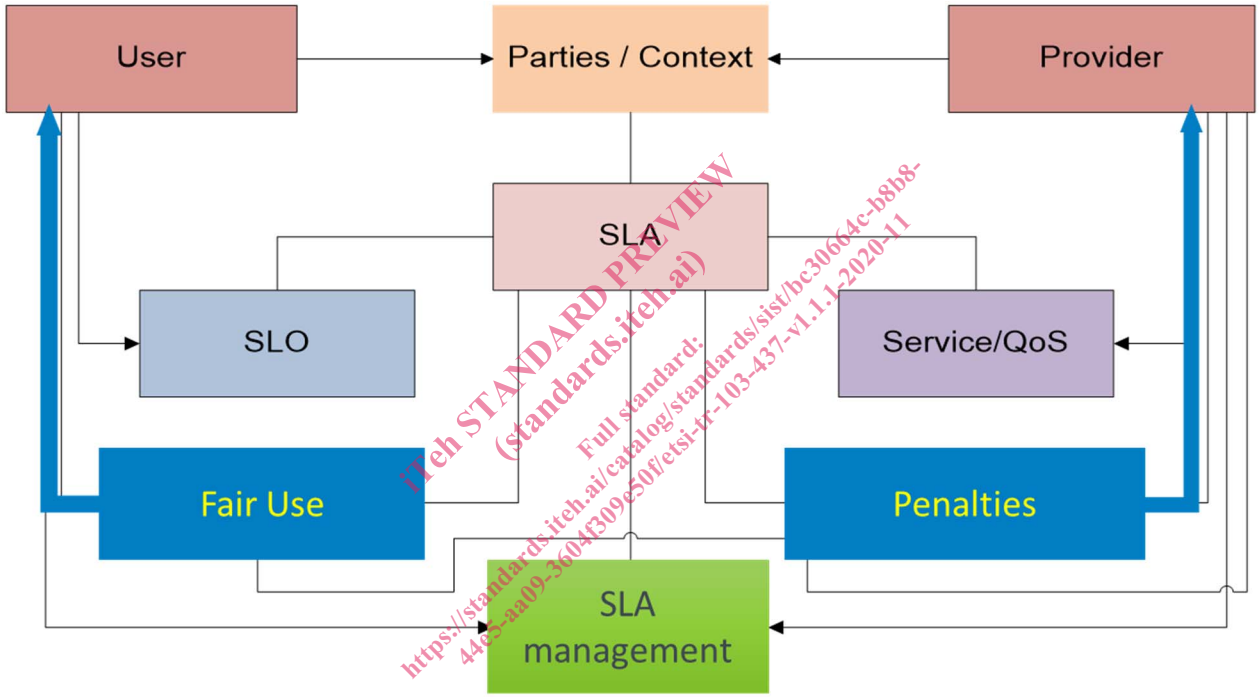

Figure 2: End to end service: conformity with SLA

The SLA parties represent the contracting entities of an SLA contract.

The SLA can be described in two parts:

- The users request their requirements, i.e. SLO and obligation, corresponding to the demand.
- The offer by Cloud provider with the guarantees provided (QoS associated to services offers, penalties) corresponding to the supply.

On the user side, a SLO aims at expressing the user needs. For example: service is available 7/7 and 24/24, access time to the application < 1 s in 90 % of cases, a processing time < 2 s if the number of requests per second < 1 000 in 90 % of cases. The user has the obligation to check the correct functioning of the service.

On the provider side, the services offered are twofold: usage and management. In accordance with the proposed model, every service component integrates a QoS control. Four criteria are proposed [i.4] to describe the behaviour (QoS): availability, integrity, time, and capacity.

From the provider point of view, the objective is to meet the required properties based on customer requirements and needs. In practice, many providers offer the same services that differ in their quality of service levels, price, and in the way, they are created, deployed, and managed. Therefore, the request and the offer should be entirely and explicitly documented and guaranteed by the Service Level Agreement (SLA). The approach presented in ETSI EG 202 009-3 [i.5] allows to model the SLA personalized where user requirements and provider offers converge on a QoS contract.

5 Service offered

5.0 As-a-Service environment

Digital ecosystem, cloud computing and Internet of Things (IoT) are promising to build a new ecosystem where everything is provided "As-a-Service". The "As-a-Service" is the main driver to support digital transformation, that can be translated by "flexibility in the service of business" respecting the quality.

The enterprise should prepare for these changes, which may also require a redesign of its core business, because what can really lead to success is the design of the customer experience. Quality experiences are based on the customer empathy, business analysis, and cognitive technologies, all of which can lead to a successful business strategy. It also means having the ability to meaningfully engage customers and employees, no matter where they are.

This inevitably incorporates the effective use of operational and virtual IT models, which include dynamic provisioning of the infrastructure, the ability to automatically scale it up, applications in the form of micro-services, and ultimately "cloudification" of the digital ecosystem.

The services are built through the composition of services that exist today in the enterprises or can be provided by providers. This approach should be based on:

- designing "As-a-Service";
- building the service by composition; and
- managing it (based on decision-making information).

To comply with the QoS principles, a service should fulfil five important points:

- to be defined through a contract;
- to be evaluated itself through criteria;
- to be measured through significant parameters at each level of visibility;
- to formalize the non-functional aspects of each action;
- to be aggregated for an end-to-end flow.

5.1 Service definition

The service provider is responsible for the creation of a service, to document the functional descriptions in the directory and to provide the interface. Depending on the level of "freedom wanted by the user" (according to Figure 3) the composition may be called on in an autonomous way (step by step) or globally (only the final result is provided to the user).

Figure 3: Service provider

The most important concepts in digital environments are QoS and service composition. This is expected to offer the maximum number of services among a large set of providers. This means that the following question should be answered: what can be offered in term of composition (by construction)?

The concepts to achieve maximum provider agility to provide the highest user level of "freedom" in the service composition are:

- "As-a-Service", micro service, service profile.
- QoS and API (Application Programming Interface) for each micro service and composition.

5.2 "As-a-Service" properties

5.2.0 "As-a-Service" in the new architecture

To better understand the expectations of service creation and management, it is necessary to situate them in the Internet of Things or Cloud Computing architecture.

The properties of "As-a-Service" components have to comply with a set of requirements. These properties are spread among the following categories related to:

- The definition of the structure and the formal descriptions of service components, i.e. the nodes themselves.
- The definition or design of the service logic and functional architecture of service components, i.e. the interactions between the service components.
- The management of the service components.

Models / Features		as-a-Service
Structure	Cohesion	✓
	Reuse	✓
	Abstraction	✓
	Invariance	✓
	Statelessness	✓
	Mutualization	✓
Interactions	Loose coupling	✓
	Invocation	✓
	Composition	✓
Management	Description	✓
	Registration	✓
	Exposition	✓
	Auto-management	✓
	Ubiquity	✓

Figure 4: "As-a-Service" properties

These properties are necessary to design components "as a service" so that from the catalog components can be chosen and assembled easily. In particular, the structure properties like "stateless" and "mutualization", the "loose link" property and those of "self-management and ubiquity" management are very important.

5.2.1 Properties related to service structure

Properties related to the service structure are:

- Reuse;
- Mutualization;
- Cohesion;
- Abstraction;
- Invariance;
- Statelessness; and
- Composition.

Reuse: the possibility of reuse is needed to simplify the software development of services that meet the new needs. Services designed based on this approach and properties (As-a-Service) would be reusable, thanks to the generic character of their interfaces (usage, control and management). A service component should be reusable to build different services, in different compositions and different environments.

Mutualization: a service provider should offer the same service component instance As-a-Service to multiple users. Mutualization stands here for multi-tenancy. Service components should support multi-tenancy in order to be invoked by multiple users requiring the offered service either simultaneously or not. This reinforces the statelessness and the loose coupling features. Mutualization requirement calls for a need for loose bindings or connections between service components to ensure the capacity to provide multiple users and answer multiple service requests autonomously. Thus, mutualization will help realizing minimum functional coupling and loose coupling between functions.