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Fifth Generation Fixed Network (F5G); Architecture and data models for residential service quality monitoring

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Foreword

This Group Specification (GS) has been produced by ETSI Industry Specification Group (ISG) Fifth Generation Fixed Network (F5G).

Modal verbs terminology

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1 Scope

The present document defines the system architecture for residential service quality monitoring (service KQI's, network KQI's) based on ETSI GS F5G 017 [1]. The corresponding technical requirements, interfaces and data models of the system are also be specified.

2 References

2.1 Normative 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.

Referenced documents which are not found to be publicly available in the expected location might be found at https://docbox.etsi.org/Reference.

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The following referenced documents are necessary for the application of the present document.

[1] ETSI GS F5G 017: "Fifth Generation Fixed Network (F5G); F5G Measurement Specification for Residential Services Quality Evaluation".

[2] IETF RFC 4251: "The Secure Shell (SSH) Protocol Architecture".

[3] BBF TR-069: "CPE WAN Management Protocol -- Issue: 1 Amendment 6".

[4] Recommendation ITU-T G.988: "ONU management and control interface (OMCI) specification".

[5] IEEE 802.11a™-1999: "IEEE Standard for Telecommunications and Information Exchange Between Systems - LAN/MAN Specific Requirements - Part 11: Wireless Medium Access Control (MAC) and physical layer (PHY) specifications: High Speed Physical Layer in the 5 GHz band".

[6] IEEE 802.11b™-1999: "IEEE Standard for Information Technology - Telecommunications and information exchange between systems - Local and Metropolitan networks - Specific requirements - Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications: Higher Speed Physical Layer (PHY) Extension in the 2.4 GHz band".

[7] IEEE 802.11g™-2003: "IEEE Standard for Information technology-- Local and metropolitan area networks -- Specific requirements -- Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications: Further Higher Data Rate Extension in the 2.4 GHz Band".

[8] IEEE 802.11n™-2009: "IEEE Standard for Information technology -- Local and metropolitan area networks-- Specific requirements -- Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications Amendment 5: Enhancements for Higher Throughput".

[9] IEEE 802.11ac™-2013: "IEEE Standard for Information technology -- Telecommunications and information exchange between systems–Local and metropolitan area networks -- Specific requirements -- Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications -- Amendment 4: Enhancements for Very High Throughput for Operation in Bands below 6 GHz".

[10] IEEE 802.11ax™-2021: "IEEE Standard for Information Technology -- Telecommunications and Information Exchange between Systems Local and Metropolitan Area Networks -- Specific Requirements Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications Amendment 1: Enhancements for High-Efficiency WLAN".

[11] IEEE P.802.11be™: "IEEE Draft Standard for Information technology -- Telecommunications and information exchange between systems Local and metropolitan area networks -- Specific requirements - Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications Amendment: Enhancements for Extremely High Throughput (EHT)".

[12] IETF RFC 8259: "The JavaScript Object Notation (JSON) Data Interchange Format.

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.

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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.

Not applicable.

3 Definition of terms, symbols and abbreviations

3.1 Terms

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

data cleansing: process of detecting and correcting (or removing) corrupt or inaccurate records from a record set, table, or database

telework: practice of working from home, making use of residential internet, email, telephone, etc.

3.2 Symbols

Void.

3.3 Abbreviations

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

5G	5nd Generation (mobile networks)
AP	Access Point
BSSID	Basic Service Set Identifier
BTV	Broadband TV
CO	Central Office
CPU	Central Processing Unit
CSV	Comma-Separated Values file
DNS	Domain Name Server
E2E	End to End
E-ONU	Edge-ONU
GB	GigaByte
HTTP	Hypertext Transfer Protocol
ID	Identifier
IP	Internet Protocol
IPTV	Internet Protocol Television
JSON	JavaScript Object Notation
KPI	Key Performance Indicator

KQI	Key Quality Indicator
LAN	Local Area Network
MAC	Medium Access Control
MOS	Mean Opinion Score
OMCI	Optical Management & Control Interface
ONU	Optical Network Unit
PING	Packet Internet Groper
PLR	Packet Loss Radio
P-ONU	Primary ONU
RAM	Random Access Memory
ROM	Read-Only Memory
RSSI	Received Signal Strength Indicator
RTT	Round Trip Time
SFTP	SSH File Transfer Protocol
SSID	Service Set Identifier
SSL	Secure Socket Layer
STA	Station
TCP	Transmission Control Protocol
TLS	Transport Layer Security
TV	Television
URL	Uniform Resource Locator
UTC	Coordinated Universal Time
VOD	Video On Demand
VR	Virtual Reality

4 General requirements

4.1 Overview of framework architecture

Figure 1 shows the functional architecture of the residential service quality monitoring. The functions of the monitoring system include service KQI monitoring, network KQI monitoring and network KPI monitoring. Network KQI monitoring can be initiated through a service-oriented monitoring platform or network-oriented monitoring platform.

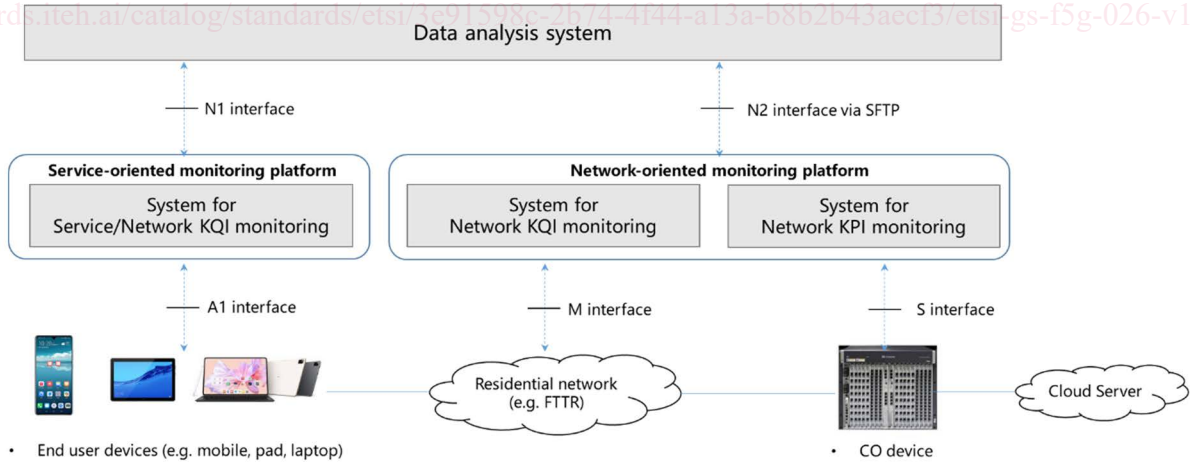


Figure 1: Functional architecture of the residential service quality monitoring

The user initiated monitoring function is performed by the interworking of the end user devices, the service-oriented monitoring platform and the data analysis system. It collects the service KQIs and subset of the network KQIs. The user initiated monitoring function communicates over the A1 interface between end user devices and the service-oriented monitoring platform and over the N1 interface between the service-oriented monitoring platform and the data analysis system (see Figure 1). The data collected from the end user devices is reported to the data analysis system.

The network KQI monitoring function is performed by the interworking of the residential network, the network-oriented monitoring platform and the data analysis system. It collects the network KQIs. The network KQI monitoring function communicates over the M interface between the residential network and the network-oriented monitoring platform and over the N2 interface between the network-oriented monitoring platform and the data analysis system (see Figure 1). The residential network collected data is reported to the data analysis system.

The network KPI monitoring function is performed by the interworking of the CO device, the network-oriented monitoring platform and the data analysis system. It collects the network KPIs. The network KPI monitoring function communicates over the S interface between the CO device and the network-oriented monitoring platform and over the N2 interface between the network-oriented monitoring platform and the data analysis system (see Figure 1). The CO device collected data is reported to data analysis system.

The present document only specifies the A1 and N2 interfaces. The N1 interface is vendor proprietary, defined by the service-oriented monitoring platform provider. The M interface is not specified in the present document and can leverage existing protocols (BBF TR-069 [3] or OMCI [4]). The S interface not specified in the present document and is for further study.

The network-oriented monitoring platform or the data analysis system can be part of network management system or a separate system. In the integration case, the network resources, the monitoring and the management can be performed through a common protocol stack.

The security of data exchange is protected through transport layer. The N2 interface shall use Security File Transfer Protocol (SFTP). TLS/SSL shall be used in A1 interface for data protection.

4.2 Monitoring the service/network KQIs by the service-oriented monitoring platform

4.2.1 Overview

The user initiated monitoring shown in Figure 2, it is mainly performed by the end user to obtain the service KQI and a subset of the network KQI. The data collected covers various network services, including web browsing, uploading/downloading, IPTV, online games, cloud games, online education/telework, cloud VR video, and cloud VR games [1]. The basic network KQIs includes throughput, latency, packet jitter, packet loss rate, and Wi-Fi® handover [1].

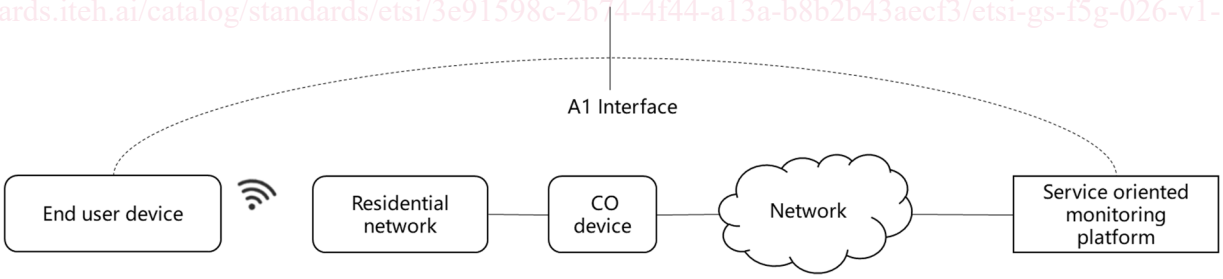


Figure 2: Monitoring of the service/network KQI through the service-oriented monitoring platform

4.2.2 Service-oriented monitoring functional model

Figure 3 shows the functional model of the service-oriented monitoring platform, including the interface module, the service KQI monitoring module, the network KQI monitoring module, and the basic info collection module.

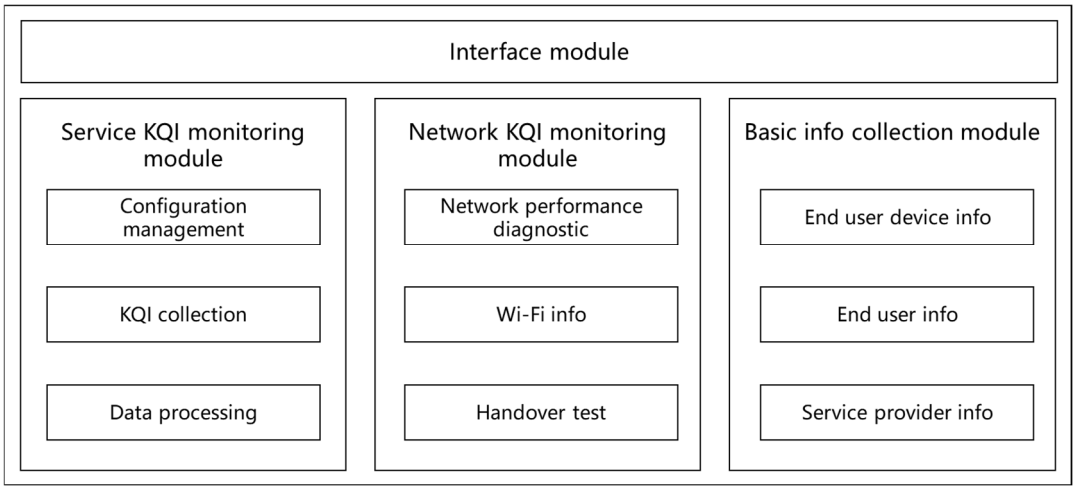


Figure 3: Functional model of service-oriented monitoring platform

The main function of the interface module is to encapsulate the message exchanged between the end user device and the service-oriented monitoring platform.

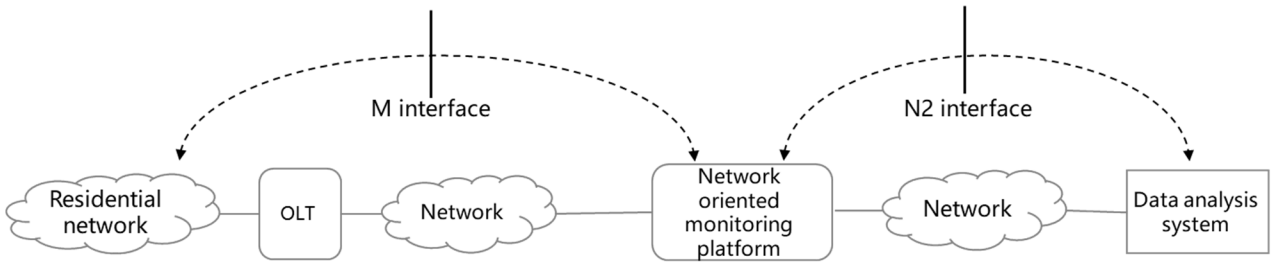
The service KQI monitoring module is part of the end user device, which collect the under-test network service information for the service-oriented monitoring platform. Such information contains the collected raw data for the network service KQI, the calculation of service KQI and the corresponding MOS values. The results are then uploaded to and stored in the service-oriented monitoring platform. The service-oriented monitoring platform completes the data processing. The end user can request the historical service KQI data and the corresponding ranking according to the MOS value compared with the other end users.

The network KQI monitoring module collects the network KQI, including the packet loss rate, the latency, the packet jitter, the Wi-Fi® handover data, and Wi-Fi® relevant information (refer to Table 7 in clause 5.4.2.6). All the data is uploaded to and stored in the service-oriented monitoring platform.

The basic info collection module collects the end user device software/hardware information, the basic end user information, and the service operator information. This data is uploaded to and stored in the service-oriented monitoring platform.

4.3 Monitoring the network KQIs by the network-oriented monitoring platform

The network KQI monitoring system (see Figure 1) collects the network KQIs for the network-oriented monitoring platform, generates the network performance data files, and transmit them to the data analysis system for management purposes. As shown in Figure 4, the network KQI monitoring function communicates over the M interface and the N2 interface (as described in clause 4.1). The network-oriented monitoring platform exports the network performance data files per collection cycle. The network performance data file is generated in the Comma Separated Values (CSV) format and the file is uploaded to the data analysis system.



NOTE: The application data flow is not shown in Figure 4.

Figure 4: Monitoring network KQI based on the network-oriented monitoring platform

5 Interface and data model for monitoring service KQIs

5.1 Overview

The end user initiates the monitoring which includes the collection of the service KQI and a subset of the network KQI, which corresponds to those in the current clause and clause 6.2 and clauses in ETSI GS F5G 017 [1].

5.2 A1 Interface

The A1 interface is a communication interface between the end user device and service-oriented monitoring platform.

The main functions of the A1 interface are as following:

1) Data reporting: including the basic user and network information, the end user device information, the service KQIs, and the network KQIs.

2) Data query: send query requests to the service-oriented monitoring platform to obtain test configuration and processing result.

5.3 Monitoring protocol

The software interface is encapsulated in JSON over HTTP/1.1, as shown in Figure 5.

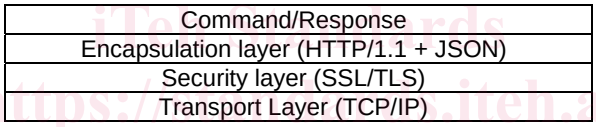


Figure 5: A1 interface stack

The format of the report request message sent over the interface is as follows:


```
POST /[path] HTTP/1.1
Accept: application/json
Content-Type: application/json; charset="utf-8"
Host: [host: port]
Content-Length: xxx
url: http://XX
[Report request parameters]
```

An example of a response message sent by the platform is as follows:

```
HTTP/1.1 200 OK
Content-Type: application/json; charset="utf-8"
Content-Length: xxx
{
    "code":
    "data": {
       Response parameters
    },
    "message":
}
```

SSL/TLS shall be used to negotiate a stateful connection by using a handshaking procedure, in which the client and server agree on various parameters used to establish the connection's security.