

# Research on the Establishment and Evaluation of End - to - End Service Quality Index System

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**Abstract.** From the perspective of power data networks, put forward the index system model to measure the quality of service, covering user experience, business performance, network capacity support, etc., and gives the establishment and use of each layer index in the model.

## 1. Introduction

In a certain network resources under the conditions, more and more problems about poor business performance and poor user experience are exposed in the certain network resources. How to improve the quality of data network business from the user point of view is becoming an urgent problem to be solved. From the current situation of power data network, the network quality and user satisfaction with the business don't form an effective correlation mechanism. In some cases, there is a better network quality with poor user satisfaction with the business. The improvement of the power data network performance indicators can't be converted to enhance the users' experience the quality of service effectively. It can be seen that the traditional quality optimization based on network optimization has not been able to meet the current needs. It is necessary to establish a new user-perceived quality of service optimization method and study the impact of network KPI on end-to-end service quality, to optimize the business and guide the work of troubleshooting [1].

## 2. Related research

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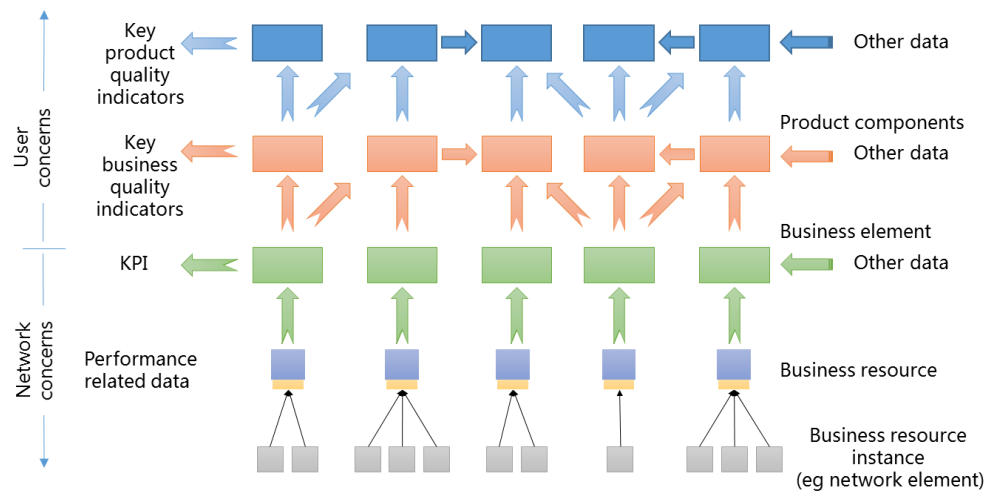
For the method of linking the user subjective perceived quality and the objective quality of the network and the business, the standardization organizations and the telecommunications equipment manufacturers have had some preliminary research results. Because of the short time on the study of the direction, the specific implementation of the program has not yet formed a consistent, concrete implementation of the program.



The standardization organization's research remains in the conceptual and framework stages, and can't give a concrete implementation of the guidance program for complex data services. Because different organizational has different research dimensions and different focus, so the results of different organizations can't be simply integrated.

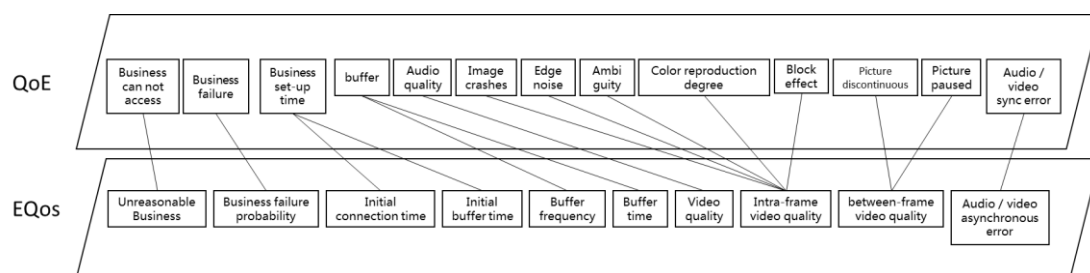
Equipment manufacturers currently only stay in the network optimization because of the nature of its own limitations. They don't do in-depth analysis of the specific business for the subjective business and users' subjective feelings.

TMF (Telecommunication Management Forum) proposed the concept of business performance indicators (KQI), network performance indicators (KPI) and mapping model of KQI to KPI, as shown in Figure 1. There is no detailed study of the subjective experience quality in the model [2].



**Figure 1.** TMF quality system and mapping model.

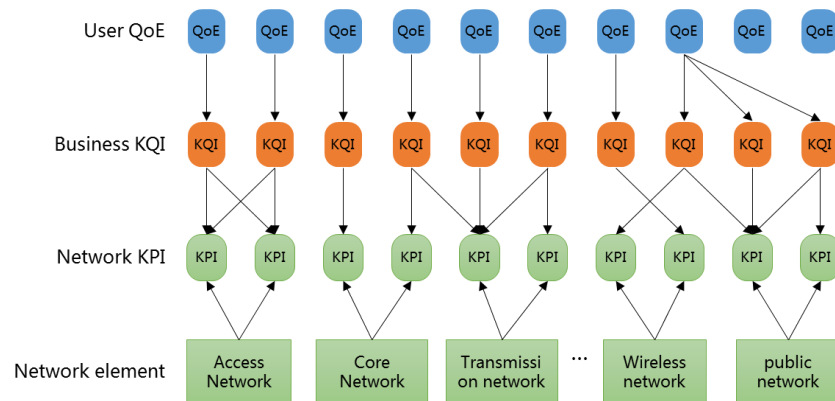
3GPP proposed a mapping model of QoE (User Subjective Quality of Experience) to ESQoS (QoS of End-to-End Services) for video services, as shown in Figure 2. This model does not propose a business generic model and is less operational [3].



**Figure 2.** 3GPP mapping model for QoE and ESQoS

### 3. Establish a model for business quality index system

Combined with TMF and 3GPP research model and the actual situation of the power data network. This paper will establish a complete business quality end-to-end index mapping system model for "user experience indicators - business key performance indicators - network key performance indicators", as shown in Figure 3. In the three-layer model index system, the index of each layer are described below.



**Figure 3.** Three-layer model index system

User experience index (QoE). The quality of the user experience is the subjective experience

### 3.1. User experience index (QoE).

The quality of the user experience is the subjective experience of the user for the quality and performance of the equipment, network and system, application or business). It can be assessed by qualitative or approximate quantification.

### 3.2. Key performance indicators for business (KQI).

KQI reflect the performance of the services which is provided by different business. They are defined from a business perspective, such as login success rate, page opening delay, etc. KQI can be quantitative measured.

### 3.3. Network Key Performance Indicators (KPIs).

KPIs reflect the performance of the network or network element. They are defined from the perspective of network or network element, such as paging success rate, PDP activation success rate and so on.

QoE is divided into two parts: objectivity index and subjectivity index. The objectivity indicators can be mapped to KQI. The subjective indicators can be directly based on subjective evaluation results to guide business optimization, without mapping to KQI [4-5].

The KQI measures the objective performance of the business. Each KQI is associated with one or more KPIs of the network / network element on the corresponding business process path. The model associates the user's perception of the business with business performance, network performance to help to improve the business performance targeted according to the user experience. The model will be A and B, C linked to help to improve the business performance targeted; according to the user experience [6]. The mode helps to locate the problem as quickly as possible and guide the optimization of the business, when here is problems of the quality of service.

## 4. Establish service quality index system

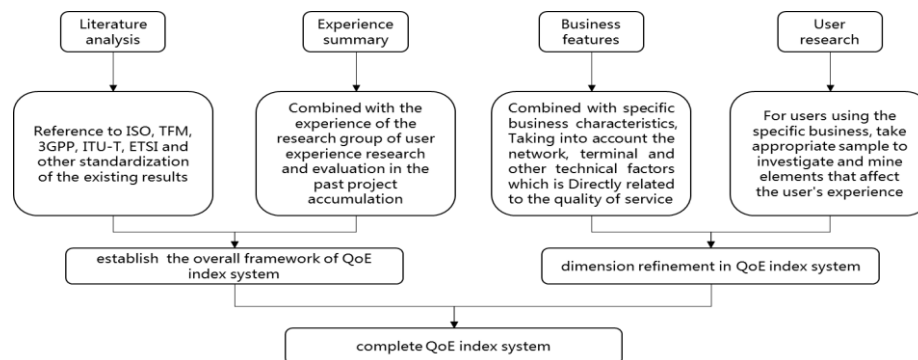
### 4.1. Create QoE

The technical and non-technical factors together affect QoE, as shown in Table 1.

**Table 1** influencing factors on QoE

Technical factors	Non-technical factors
End-to-end QoS assurance mechanism	User subjective satisfaction and operational service quality
End-to-end business KQI	Business convenience / availability
Network Connectivity and Transmission Capability KPI	Service Content
Network / service coverage	Brand and price
Terminal function / performance	Customer service support, User perceived thresholds, expectations and behavioral habits

Through the investigation of the level of QoE, we can get the actual perception of the business from users. The creation method shown in Figure 4.

**Figure 4.** Create QoE

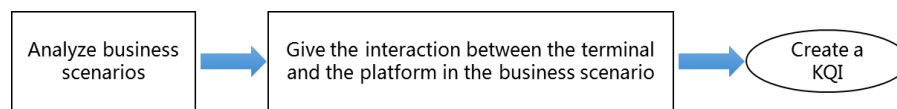
According to the subjective strength, QoE for business can be divided into two categories -- subjective indicators and objectivity indicators. Subjective indicators reflect the user's subjective feelings of the business, there is no objective measure and is independent of the support capabilities on the network.

When these indicators are found to be low, the problem can be directly addressed to the relevant responsible party, without mapping to KQI [7]. Objectivity indicators reflect the performance of the business. The value of the objectivity index can be obtained by dialling on the network, such as the success of order / unsubscribe, the page open speed, etc. These indicators can be mapped to the business KQI.

#### 4.2. Create KQI

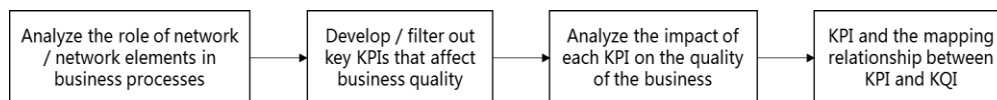
The business in the power data network needs the participation of the network to complete business functions.

KQI is used to measure the performance of various functions of the business indicators[8]. The KQI is affected by terminals, networks, business platforms, operations support systems, and so on. It is necessary to consider the business availability, reliability, speed 3 aspects while designing KQI for the corresponding business. Availability is used to measure whether a business operation can be successfully completed (such as login success rate, etc.); Reliability is used to measure whether a business function can maintain normal status from start to finish (such as online business dropped rate, multimedia on-demand playback success rate, etc.); Speed is used to measure the completion of business functions, data download rate (such as login delay, download rate, multimedia playback, the frequency of buffering, etc.). The creation method of KQI is shown in Figure 5.

**Figure 5.** Create KQI

#### 4.3. Create KPI

Business processes of data services are generally initiated from the terminal, through the access network, the core network and the service network, and reaching the service platform [9]. The service platform executes relevant business logic, and return the result to the terminal. Therefore, KPI of the access network, KPI of the core network, KPI of the service network, KPI of the operation support system, and KPI of the service platform on the network all affect the end-to-end KQI of the service. Since the data traffic has a certain commonality in business processes, including open between sites, client login, client and platform messaging interactions, so when creating a KPI, we can analyse the impact of KPIs of the network element on business processes in a common business scenario. These research can be used for the establishment the mapping relationships the relationships KQI and KPI of specific business. The KPI creation method is shown in Figure 6.

**Figure 6.** Create KPI

### 5. Measurement and use of index values

For the subjective indicators in QoE, various aspects of the subjective experience of users can be obtained through a method of subjective evaluation. Indicators that have lower satisfaction are targeted to improve.

Questionnaire, depth of interview, usability test / eye movement test are the most classic user experience in the field of QoE evaluation methods. In the course of business QoE assessment, the above methods can be selected flexibly according to need [3].

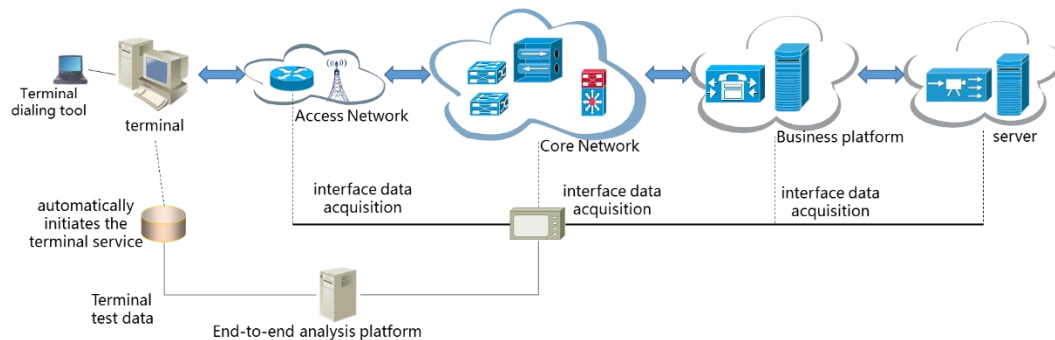
For the objectivity index in QoE, on the one hand, we can get the expectation and patience of the user's performance by the subjective evaluation method. On the other hand, we can get the objective value (the corresponding KQI value for the QoE) through the Network dialing on the actual network.

When the actual quality of the business can't meet the user's expectations or patience level, the corresponding KQI should be enhanced to improve business performance based on users' needs.

According to the measurement range, KQI can be divided into two categories. One KQI is the end-to-end KQI, which characterizes the end-to-end performance of the service and can be obtained by dialing manually or dialing automatically. The other KQI is the terminal side of the sub-KQI, which characterizes the performance of all aspects of the terminal in the process of completing the task, such as the success rate of each session, the delay, etc., and can be obtained through the terminal dialing tool.

Network / network element KPI part can be collected by the network management system. The end-to-end test analysis platform to obtain network / network element KPI data, through the network management system interface. For delay-related KPIs that can't be obtained through the NMS, are need to be detected by deploying test instrument tests on each node on the network [10].

In the specific using, we can develop the reference value of each KQI through a large sample of the test data. When the end-to-end KQI exceeds the reference value, check the segment KQI again. When the end-to-end KQI exceeds the reference value, check the segment KQI again. The test tool performs an end-to-end test of the service, as shown in Figure 7.



**Figure 7.** End-to-end test of the service

## 6. Conclusion

Based on the business requirements of the power data network, this paper studies the model of service quality indicators, the establishment and use of indicators, and analyses the test tools to test the indicators of each layer to guide the business optimization and troubleshooting.

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