EXTRACT
PUBLIC INTERNATIONAL TENDER (BID)
2015LI-000002-SUTEL

1. Introduction

The Superintendencia de Telecomunicaciones (hereinafter referred to as SUTEL), the Costa Rican telecommunications regulator, published the invitation to bid for the public international tender named *2015LI-000002-SUTEL "Arrendamiento operativo de un sistema de medición y evaluación de la calidad de los servicios de telecomunicaciones a nivel nacional (Leasing of a quality of service measurement and evaluation system for the telecomunications nationwide)"*.

This document is an extract of the most relevant requirements established in the bidding rules of the tender 2015LI-000002-SUTEL with the sole and only purpose to give a general description of the project and to invite any interested companies in the bidding process of this public international tender.

SUTEL hereby declares that this document is not and in any manner will constitute the bidding rules of this Project, nor it will modify them. All legal and technical matters of this tender are governed by the provisions stated in the document identified as *2015LI-000002-SUTEL "Arrendamiento operativo de un sistema de medición y evaluación de la calidad de los servicios de telecomunicaciones a nivel nacional"* drafted in Spanish. In case there is a difference between the terms used in this document in English and the terms stated in the tender in Spanish, the Spanish version shall prevail.

2. Summary of the most relevant technical requirements of 2015LI-000002-SUTEL

2.1. Object of the tender

The object of the tender 2015LI-000002-SUTEL (hereinafter referred to as the tender) is the leasing of an evaluation system of the quality of service (QoS) of the telecommunications nationwide. Such system shall allow to collect data of the QoS in a continuous manner for a minimum period of six years, with the purpose to evaluate and execute statistical studies of the performance of the services in a way that allows to compare and inform about the QoS provided by the different network operators, as well as the study of any trends and the evolution of the telecommunications services in the country.

2.2. Telecommunications servicies to evaluate

The evaluation system must have the capability to measure and evaluate the level of QoS of the following telecommunications services:

1. Mobile voice network
2. Mobile Internet access network
3. Fixed Internet access

The hereinabove listed services must be measured and evaluated employing at least the following Key Performance Indicators (KPI´s):

Unsuccessfull call ratio. The unsuccessfull call ratio is the ratio of unsuccessful calls to the total number of call attempts in a specific time period. Please refer to the ETSI EG 201 769 recommendation for fixed telephony evaluation and ETSI EG 202 057-3 recommendation for mobile telephony evaluation.

Voice quality. The voice quality of the telephone services is obtained by the comparison of the characteristics of the signal (sounds and voice) transmitted in contrast to the received signal on a telephony communication. Please refer POLQA test described in the UIT-T P.863 Recommendation to evaluate this KPI.

Call setup time. The call setup time is the amount of time elapsed from the moment the routing information required to establish the call is received by the network (this means that is recognized by the access network of the calling party) until the calling party receives a busy tone, dial tone or response signal. Please refer to the ETSI EG 201 769 norm.

Dropped call ratio. The dropped call ratio is the measurement of the ability of the mobile network used by the service provider to maintain a call, both incoming and outgoing, once it has been correctly established. This KPI measures the failure in coverage, problems with the quality of the signal, network congestion and network failures. Please refer to the ETSI EG 202 057-3 norm.

Coverage area. Is referred to the signal strength (in dBm) received by the user equipment (UE). For GSM networks, the coverage area corresponds to the received BCCH signal at maximum power. For 3G networks, correspond to the received CPICH RSCP signal. For LTE networks, it corresponds to the received RSRP signals.

SMS delivery time. The SMS delivery time is defined as the time from the instant that a SMS is sent, from an active terminal equipment and connected to a mobile network, to a short message center, and the instant in which that same SMS is received in a different terminal equipment, which must also be active and connected to a mobile network. Please refer to the ETSI EG 202 057-2 recommendation for the evaluation of this KPI.

Local Delay. The local delay KPI is given by the round trip time (RTT), measure in milliseconds, of an ICMP data package sent to an Internet node in Costa Rica. Please refer to the ETSI TS 102 250-2 and ITU-R M.1636 recommendations for the evaluation of this KPI.

International Delay. The international delay KPI is given by the round trip time (RTT), measure in milliseconds, of an ICMP data package sent to an Internet node located in an international location. Please refer to the ETSI TS 102 250-2 and ITU-R M.1636 recommendations for the evaluation of this KPI.

Data transfer rate. This KPI is defined as the throughput (in bit per second) of an Internet access service, for both downlink and uplink. Please refer to the ETSI EG 202 057-4 recommendation for the evaluation of this KPI.

In the chart hereinunder are specified and highlighted in grey the KPI´s applicable for each telecom service.

KPI	Mobile Telephony	Mobile Internet	Fixed Internet
Unsuccesfull call ratio			
Voice quality			
Call setup time			
Dropped call ratio			
Signal Intesity			
SMS delivery time			
Local delay			
International delay			
Data transfer rate			

Optionally, the evaluation system could have the capacity to additionally evaluate the following telecom services:

1. Plain Old Telephone Service (hereinafter referred to as POTS). This service must be evaluated using the following KPI´s: unsuccessful call ratio, voice quality, and call setup time described hereinabove.
2. IP telephony. This service must be evaluated using the following KPI´s: unsuccessful call ratio, voice quality, and call setup time described hereinabove, and additionally the voice delay KPI, as described hereinunder:

Voice Delay. The voice delay is the time elapsed between the instant that a signal is transmitted from the calling party, until the moment that the signal is received by the called party. Please refer to the ITU-T G.114 recommendation for the evaluation. The results can also be obtained from the POLQA test described in ITU-T P.863 recommendation.

2.3. *General description of the required evaluation system.*

SUTEL requires to hire a distributed measurement system that can be outspread in different locations of the country, and allows to obtain performance and QoS data of the telecommunications services for a minimum period of six years. It must also be able to generate and publish reports with the results of the evaluations performed.

The measurement system required by SUTEL must have the following basic functional elements:

Measurement Unit of Quality (MUQ): It is defined as the set of hardware and software elements that have the capability to evaluate the telecom services QoS levels.

Measurement point (MP): Is defined as the location in which converge different telecommunications services and has the capacity to host in a safe manner the MUQ and to provide the necessary electrical power during the total time of the lease of this project.

Test servers (TS): These are defined as physical or virtual machines that act as counterpart of the MUQ in the performance of telecommunications services QoS tests. Examples of measurement servers are: FTP and HTTP servers for data testing, servers with active POTS lines that act as automatic response robots to answer phone calls from the MUQ.

Management servers (MS): These are defined as one or more physical or virtual machines that perform administrative tasks of the measurement system. Examples of management servers are: applications for remote configuration and control of the MUQs, active and out of service MUQ registry, failure and request for support registry, data bases, storage of the measurement results, processing and post processing of the measurement results, generation of reports, graphic display of historical and real time measurement results (dashboard type), and web servers to publish the results.

The measurement system required by SUTEL must have an architecture in which the MUQs can be outspread. Thus, the measurement system must be made-up by a set of MUQs outspread in different areas of the country, called Measurement Points, and described hereinabove. As an essential feature the equipment must be easy to transport.

2.4. *Specific description of the required measurement system.*

2.4.1. Description of the Measurement Units

Conceptually, a MUQ is a set of hardware and software elements with the capability to evaluate the telecommunications services hereinabove mentioned in Section 2.2.

A MUQ must have a minimum capacity to evaluate simultaneously six mobile services, each mobile service providing voice and data (Mobile Operator hereinafter referred to as MO) and y four fixed Internet services (Internet Service Provider hereinafter referred to as ISP). The following figure exemplifies the conceptual structure of a MUQ.

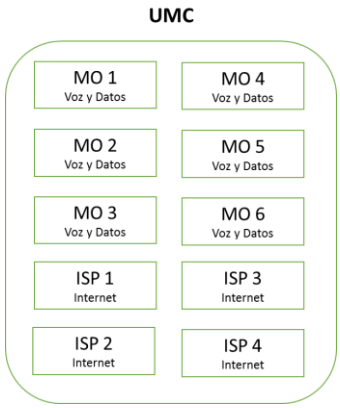

***Figure 1**. Image of a MUQ´s basic requirements.*

The MUQ could have additional capacity to simultaneously evaluate the optional services hereinabove mentioned in Section 2.2. These services are: one service of POTS and four services of IP telephony (hereinafter referred to as VoIP). The following figure exemplifies the conceptual structure that evaluates the optional services.

Figure 2. Image of a MUQ with additional capacity

The MUQ must be modular and allow the scalable growth to evaluate telecom services. Unambiguously, it must be able to duplicate the aforementioned capacity.

The MUQ must be capable to continuously perform its tasks in exteriors, therefore it must be duly protected from the weather, including but not limited to any changes in temperature, humidity, rain, lightning, dust, overvoltage, voltage and current spikes.

The MUQ could be physically built as single unit of structure that shelters the total of the hardware and software, or as separate structures that shelter the total of the hardware and software. In either case, the physical structure must ensure that the equipment is protected and in optimal operational conditions in exteriors environments. It must also guarantee that the cables, modems or CPE´s of Internet access provided by the ISP that will be connected to the MUQ allow the proper connection to all the telecommunications services that will be evaluated.

Regarding the power source of the MUQ´s, these must have the capability to connect to a electrical power system (120 VAC@60Hz). The MUQ´s must have an electrical power backup system that permits the correct performance of the MUQ for a minimum of an hour in case the electrical power is off.

The MUQ must have the capacity to collect data and the result of the evaluations made. This information must be sent to the central server to be processed and analyzed. It should also be able to connect remotely to the central server.

As for the measurement interfaces of the mobile services of the MUQ, these must operate in GSM, UMTS and LTE technologies y the following frequency bands: GSM (850 MHz and 1800 MHz), UMTS (850 MHz and 1900/2100 MHz), and LTE (1800 MHz and 2600 MHz).

For the specific case of the mobile services interfaces of the MUQ, these must permit through remote configuration to select one operator, as well as to force the system to a specific technology. It must also allow that the test runs in a manner that enables the handover between technologies. Additionally, these interfaces for evaluation of the mobile services must allow to perform POLQA tests for both incoming and outgoing calls, in such manner that the POLQA tests can be made between MUQ´s without the need to use the central server for such purpose.

The interfaces to evaluate the services of fixed Internet in the MUQ, must allow the hookup of RJ45 connectors in such manner that allows the connection of conventional network cables used to provide the Internet services. These RJ45 ports must be designed in a way that tolerates the connection and disconnection of regular network cables without any detriment in its normal functioning.

These interfaces to connect the fixed Internet services in the MUQ, must be capable to configure fixed and dynamic (DHCP) IP addresses, address resolution protocol (ARP) and reverse ARP and domain name services (DNS) resolution, as well as to evaluate the services provided through ADSL, Cable Modem (DOCSIS), WiMAX technologies, taking into account the provisioning of such services, including modem installation.

A fundamental feature of the MUQ is that they are easily transported between a measurement point and another.

2.4.2. Description of the measurement points.

An MP is a location able to shelter in a secure manner a MUQ and to provide it with the necessary electrical power for its functioning. The fixed Internet services that will be connected to the MUQ´s must be feasible to install in the MP locations.

For the location chosen for each MP, the Contractor must guarantee the capability to install a minimum of four fixed Internet services and that there is coverage of the three main network operators of the country.

For this Project, the SUTEL has defined a total of 28 counties in Costa Rica, in each of which a MP must be established. In the bidding rules are listed each of those 28 counties. The

Contractor is the obliged to determine the specific location of the MP within each of the 28 counties listed in the bidding rules.

After the first year of execution of the Project, the SUTEL may request the Contractor the replacement of one or more MP originally established. In the bidding rules are listed the possible districts to where the MUQ will be requested to be moved. In the case SUTEL unilaterally decides to move one MUQ form its original location, the contractor is given a maximum period of three months to fully move the MUQ to the new location.

Below are detailed the three possible executions of the measurement system, each of which involves a different amount of MUQs to be installed in the different MP´s.

Deployment One: The proposal of Deployment One consists in a minimum of 28 MUQs, each of which shall stay fixed and active (performing tests) in each of the 28 MP during a minimum period of one year. Once the one year time period has elapsed, the SUTEL is duly entitled to request that the MP is moved, as stated hereinabove. The following figure shows a diagram with illustrative purposes.

Figure 4. Illustrative diagram of Deployment One.

Deployment Two: The proposal of Deployment Two consists in a minimum of 14 MUQs, each of which shall stay fixed and active (performing tests) in each of the 14 MP during a period of six months, after which they will be moved to a new MP for another six month period. After a year, the 14 MUQ must have performed tests in each of the 28 counties originally listed in the bidding rules. Once the first year of evaluations has elapsed, SUTEL is duly entitled to request that the MUQ is moved from the original MP location to a new one, as stated hereinabove. The following figure shows a diagram with illustrative purposes.

Figure 5. Illustrative diagram of Deployment Two.

Deployment Three: The proposal of Deployment Three consists in a minimum of 07 MUQs, each of which shall stay fixed and active (performing tests) in each MP for a three month time period, moving to another MP for the next three months and so on, until in each the original 28 counties listed in the bidding rules a MUQ has performed the evaluations required by SUTEL. Once the first year of evaluations has elapsed, SUTEL is duly entitled to request that the MUQ is moved from the original MP location to a new one, as stated hereinabove. The following figure shows a diagram with illustrative purposes.

Figure 6. Illustrative diagram of Deployment Three.

2.4.3. Description of the test servers.

The Test Servers (hereinafter referred to as TS) physical or virtual machines that act as counterpart of the MUQs in the performance of telecommunications services QoS tests. The measurement system offered mush have enough amount of SRM entities to perform all the evaluations required by SUTEL.

The test servers must be hosted by the contractor, who is totally responsible of the operation, availability, and maintenance of such servers. The contractor shall also be responsible of the updates, scalable growth, and/or any other process necessary for its proper operation.

The Contractor shall provide SUTEL remote access accounts to all of the test servers. These accounts must have administrator rights that allow to make modifications if required.

The test servers must perform telephony tests (of the voice services) and Internet access tests.

To perform the telephony tests (of voice services) at least a TS is required within Costa Rica. This server must have installed and configured the needed amount of telephone services, in such a manner that act as automatic response robots to perform telephone calls from the MUQ, in order to measure the KPI´s of the telephone services. The POLQA tests are performed between MUQ´s. The test server must be able to meet the requirements of the total of MUQ´s that are part of the evaluation system.

To perform the data tests, the TS must be connected to Internet through at least one public IP address with no traffic shaping and enable to respond to the tests performed by the MUQ.

The system must at least have two TS entities dedicated to perform Internet access tests. One local entity, located within Costa Rica; and an international entity located in the United States within the Miami America´s Network Access Point (NAP) or any other Data Center within three hops of the aforementioned NAP.

Each of the TS must have at least one Internet connection with enough bandwidth to perform the tests requested by each of the MUQs of the complete evaluation system. For purposes of designing the test servers for the data tests (access to Internet), the Contractor must use as starting point the following capacities: each MUQ must have four fixed Internet services with a bandwidth of 2 Mbps each service and three services of mobile Internet with a bandwidth of 1 Mbps each service. For dimensioning purposes, the Contractor shall take into consideration that the Internet services installed in the MUQ are symmetrical (downlink = uplink) and that the hired speed will duplicate each year.

2.4.4. Description of the management servers (MS)

These are defined as one or more physical or virtual machines that perform administrative tasks of the measurement system. The offered measurement system might have one or more management servers to perform each task, administrate and publish the results required by SUTEL. In all cases, the management servers should have the ability to manage the total amount of the MUQs that make the complete evaluation system.

The management server should be installed in a centralized location, which shall be referred to a Control Center. The bidder shall define the location of the Control Center. SUTEL´s data center is a possibility for the installment of the Control Center. However, the selected bidder has total freedom to establish the location of the Control Center. In any case, the Control Center should allow the MS to be connected to the MUQs outspread throughout the country.

In the case the Control Center is not located within the premises of SUTEL and is hosted in a different location provided by the Contractor, the Contractor should make sure that the decided location has the necessary infrastructure to properly host the servers and the telecommunications equipment necessary for its proper operation.

In the case the Contractor proposes to install the Control Center within the premises of SUTEL, the Contractor must install and connect to the Internet access network and the local area network (LAN) of SUTEL, as well as to provide the any type of equipment that is necessary for the proper operation of the system.

The MS must have the latest version of hardware and software available, and it should remain updated for the complete period of the lease. This include the license updates, patches, and/or any other improvement that is required for the proper operation of the system. In either case, the Contractor must handle the operation and maintenance of the MS.

The MS should be accessible through a web application, which allows to perform all the management duties from such server. Such application should be compatible with the most popular Internet browsers, such as: Mozilla Firefox, Google Chrome, Microsoft Internet Explorer, Safari, and their most recent versions.

The Contractor should provide SUTEL remote access accounts to all the MS. These accounts must have administrator rights. The application should require the authentication through the validation of its credentials.

The MS should perform the following functions: control and administration, collection and storage of data, data computing and generation of reports and visual display and publication of information.

2.5. *Additional requirements of the evaluation system*

2.5.1. *Website to publish the results of the evaluation system*

The evaluation system should have a website that allows the display of the results, through a graphic interface that can be configured by SUTEL regarding the QoS KPI´s as well as the evaluation periods.

The website should be compatible with the most popular Internet browsers such as: Mozilla Firefox, Google Chrome, Microsoft Internet Explorer, Safari, and their most recent versions.

The website should be accessed from any Smartphone, Tablet, or personal computer, responsive web design (RWD) in order to ease the visualization process form the user.

The website must have a graphic interface that follows the look and feel of SUTEL´s website and its visual identity manual. The graphic design should follow the guidelines and design lines of the corporate identity of SUTEL. SUTEL will provide the CSS files for the design of the website.

The design of the website must be made by a professional graphic designer, based on the users experience and that presents the information as an intuitive web design. For this purpose the Contractor shall hire an advertising agency to design website.

The website shall be developed in a standard programming language and in a way that can be easily modified.

The website must have an application that allows SUTEL to easily modify the information that is shown to the user or the visitor of the website, allowing as a minimum the modification of the fonts, forms, sizes, logos, colors, location of the elements and type of elements.

The website must be hosted by the Contractor, who must be sure that has enough bandwidth that guarantees the user a visualization speed of less than 3 seconds for one hundred concurrent users.

The website must provide a tool that allows the statistical analysis of the incoming and outgoing traffic information. This tool must allow to generate reports of the amount of daily accesses or request of access, session's statistics, the contents visited, and the length of the sessions. It should also provide a tool that allows to monitor the availability of the website, the bandwidth usage and the servers' usage.

The website must be accessible with SSL certificates. For this propose SUTEL will provide the wildcard for .sutel domain. The website must have reCAPTCHA security mechanisms to display the KPI measurement results.

The Contractor must provide the website source code and any other files related.

2.5.2. Maintenance and operation services

- **General conditions of the preventive and corrective maintenance:**

The Contractor shall be responsible for the proper operation and preventive and corrective maintenance of the measurement system (hardware and software) for the time of the leasing.

In case a replacement of the equipment is needed due to fire, robbery, accidents, malfunctions, damage due to lightning, overvoltage, and/or any other situation that isn´t imputable to SUTEL, the Contractor shall replace it with another one with the same characteristics as the damaged equipment with no additional cost to SUTEL. In case it is needed, the Contractor shall repair any damage in the equipment or any of its components with no additional cost to SUTEL.

The Contractor shall provide local technical support in Spanish to the total of the components of the evaluation system, including support for the hardware and software of any of the

components that may affect the proper operation of the system. The hereinbefore mentioned support shall be provided by the Contractor during the total period of the leasing. For this purpose, the Contractor shall have, at least a certified technician, who must speak Spanish, live in Costa Rica and be duly trained for the use and administration of the complete evaluation system.

The Contractor must ensure the correct performance of the evaluation system and the website. The Contactor must be available 24 hours the 7 days of the week to timely correct any breakdown of the system or website. This response must be proactive and not limited to the opening of tickets or requests to solve the breakdowns by SUTEL. The Contactor should also be available for consultation from Monday to Friday from 8:00 am to 16:00 pm (GMT -6 Costa Rica).

The Contractor must have an informatics system to report the breakdowns that SUTEL files and the follow up of the breakdown, as well as the request for support and the consultations done by SUTEL. The system must have the option to interact with the users via email to inform of the opening, follow up and settlement of the breakdowns and requests for support.

- **Electrical Power:**

The Contractor must provide the necessary electrical power supply for the proper operations of all the components of the evaluation system. For the MUQs, the electrical backup must ensure a minimum of one hour of regular performance in case there is no electrical power. For the case of the MS, TS, web servers and the other components of the measurement system, this must be feed by a backup electrical system that enables a minimum of 5 hours regular performance in case there is a lack of electrical power.

The Contractor shall be responsible to supply electrical power to the total of the evaluation system and is responsible for the payment of such utility, as well as any expense generated by any necessary backup system.

- **Communication network:**

The Contractor shall be responsible of the design, acquisition and implementation of the telecommunications network required for the interconnection of all MUQs with the Control Center, as well as its maintenance and the payment of the expenses associated to such network.

The Contractor is responsible for the design, acquisition and implementation of the communications network within the Control Center required for the interconnection of the TS, MS, web servers and any other platform that is part of the Control Center. Also, it is responsible for the maintenance and payment of the expenses associated to such network.

In case the Control Center is located within the SUTEL building, the Contractor must design, acquire and install the network equipment necessary to make possible the interconnection of such network with the LAN of SUTEL.

- **Purchase of the telecommunication services:**

The Contractor must pay for all the telecommunications services that shall be evaluated in each of the MUQs. Also, the Contractor is responsible to hire such services, make the prompt payment and to settle such services when these are no longer necessary.

The Contractor has the obligation to replace, upon request of SUTEL, any telecommunications service that is being evaluated in any of the MUQs. In such event, the Contractor has a maximum of one month from the notice from SUTEL, to have the new service provisioned in the MUQ.

The Contractor should hire all the telecommunications services required for the correct performance of the TS, MS, web servers, as well as any other telecommunications service required for the proper operation of the Control Center and its interconnection with the MUQs. The Contractor is responsible of the purchase of such services, its payment and the settlement in the moment such services are no longer required.

- **Locations to establish the MP:**

The Contractor must ensure that the sites selected to establish the MP have the necessary characteristics for the correct installation of the MUQs, its electrical power, and the required facilities to install the telecommunications services connected to the MUQs.

The Contractor is responsible to execute the lease agreements or any other agreements necessary in each of the MP. Also, it is responsible to pay for the lease, and/or any other expense related to the correct installation and removal of the MUQs and the telecommunications services in the MP.

The Contractor shall be responsible to perform all the legal procedures, permits, and any other administrative proceedings with the required authorities that are necessary for the implementation and operation of the MP and the installation of the MUQs.

- **Change of location of the MUQs:**

The Contractor shall be responsible for the transfer, installation and launch of the MUQs in their allocated MP for the complete period of the lease. Therefore, the Contractor shall consider making the changes in location quarterly or biannual according to the stated in hereinabove mentioned article 2.4.2. and in case it requires a change from one of the original MP, the Contractor has a maximum of three calendar months to implement and launch the new MP.

The Contractor must transfer the MUQs to the new MP, taking into consideration all the logistics and setups required, so when MUQs are transported, they can start operating according to the operations calendar established in the design phase and in agreement with SUTEL.

The Contractor is responsible to disconnect, transfer and reconnect the MUQs each time they need to be moved. The transportation must be done in a maximum period of 24 hours.

- **Statistical services and generation of reports:**

The MS must be able to compute the collected data for purposes of generation of reports, as well as to set the thresholds to detect if the values measured comply with the ones established by SUTEL.

The MS must allow the report generation of the results of the evaluation of the telecommunications service KPI´s.

The Contractor must work with SUTEL in the drafting of templates for the quarterly and biannual reports, as well as, to create customized templates for additional reports that the Administration may require for its daily tasks.

The Contractor shall be responsible for the generation of quarterly and annual reports with the results from the evaluations performed by the MUQs, and the generation of quarterly reports of the availability of the measurement system and the preventive and corrective maintenance done.

- **Support and maintenance of the website:**

The Contractor is responsible to provide all the support and maintenance of the website, as well as its hosting including the hardware and software required for the proper operation of the website.

The Contractor must increase the capacity of the servers and the bandwidth necessary to guarantee the user a visualization speed of less than 3 seconds for one hundred concurrent users.

The Contractor must implement the international security policies required to guarantee that the website is duly protected from any cyberattack and is available for access from the website users.