



MINISTERIO
DE INDUSTRIA, TURISMO
Y COMERCIO

QoS on mobile services

Spanish approach

Fondazione Ugo
Bordoni
Bologna, Italy
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General QoS and regulatory aspects

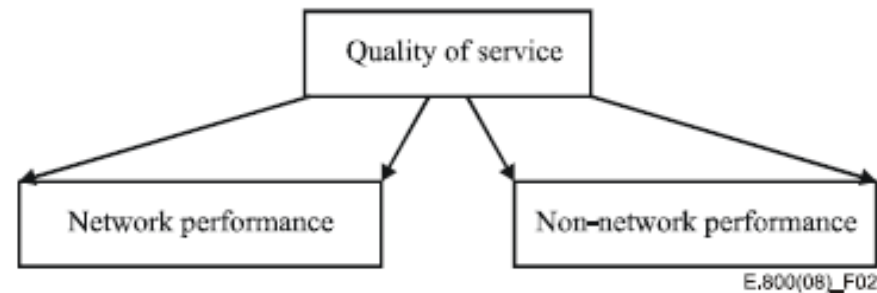
QoS regulatory framework in Spain

Practical aspects of QoS measurements on mobile services



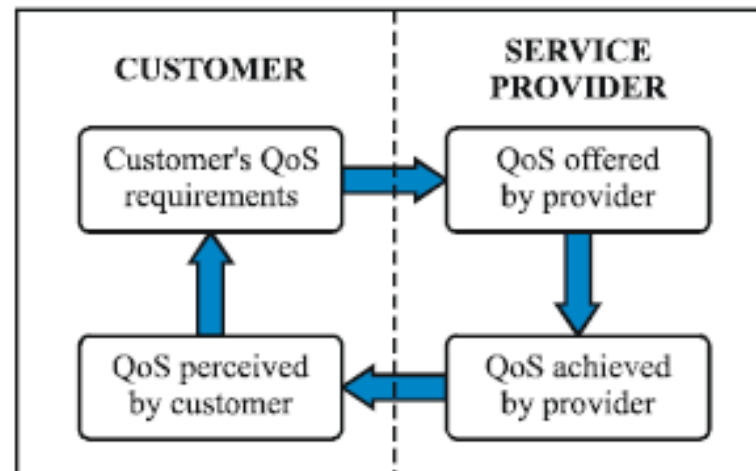
Quality of service (QoS)

QoS: Totality of characteristics of a telecommunications service that bear on its ability to satisfy stated and implied needs of the user of the service. (UIT-T E.800 Recommendation (09/2008))





Viewpoints of QoS



E.800(08)_F03

QoS information

Objective:

- Allow, together with price information, to made informed choices.

Requirements:

- Relevant: Implies that the information provided shall be meaningful for end users and refer to services which are of potential interest for their choice.
- Comparable: Implies that the information provided for each service shall refer to the same aspects (i.e. QoS parameters) and be presented in such a manner that eases the comparison between different services.
- Reliable: Implies that the information provided shall be obtained by means of a specified, clear and well founded methodology, and additionally have all the guarantees to ensures that has been correctly applied .

Only if these three requirements are simultaneously met, the QoS information can be published and be used by end users to make informed choices.

QoS legal framework at EU level (I)

Universal Service Directive (Directive 2002/22/CE):

- Article 11: QoS for operators with U.S. obligations.
 - Designated operators shall publish information on QoS.
 - NRAs may specify the parameters to be measured and set performance targets.
- Article 20: Information on QoS in contracts.
 - Information on the QoS levels offered.
 - Compensation arrangements in case of QoS compromises not met.
- Article 22: QoS for all the operators.
 - NRAs may require operators to publish comparable, adequate and up-to-date information on QoS.
 - NRAs may specify the parameters to be measured and the content and format of the published information.



QoS legal framework at EU level (II)

Directive 2009/136/CE amending U. S. Directive.

- Article 20: Information on QoS in contracts.
 - The minimum service quality levels offered, namely the time for the initial connection.
 - NRAs may require it for other QoS parameters.



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General regulatory aspects

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Regulatory Framework in Spain

- Ley 32/2003: Telecommunications Law.
- R. D. 424/2005: conditions for electronic communications services, conditions for universal service and user's rights.
- **Ministerial Order ITC/912/2006: QoS conditions on electronic communications services (Orden de Calidad).**
- R. D. 899/2009: user's rights on electronic communications services.



Ministerial Order ITC/912/2006

- Replaces Ministerial Order from 19th October 1999.
- Amended by SETSI Resolution from 28/08/2009.
- Regulated aspects:
 - QoS in Universal Service.
 - QoS compromises in contracts.
 - Quality in billing systems.
 - Information in case of severe incidents.
 - QoS information for end users.
- The NRA in charge of the implementation of QoS issues is the MITYC (Ministerio de Industria, Turismo y Comercio).



QoS in Universal Service (I)

For all the users:

- Minimum mandatory levels obtained as an average of the whole country on a quarterly basis.
- 20% maximum allowed deviation in each geographical area (autonomous region).

QoS parameter (ETSI EG 201 769)	Mandatory minimum level:
Supply time for initial connection	< 60 days for 99% of fastest supplies.
Faults rate	< 4% in a quarterly basis.
Fault repair time	< 48 hours for 95% of fastest repairs.
Unsuccessful call ratio	< 1% for national calls, < 2% for international calls and < 1% for calls to mobile phones.
Call set up time (mean time)	< 2 sec. for national calls, < 9 sec. for international calls and < 6 sec. for calls to mobile phones.
Response times for operator services	> 90% of calls answered within 20 seconds.
Bill correctness complaints	< 0,5% in a quarterly basis.
Public pay- telephones in working order	> 95% of payphones in full working order.
Response time for directory enquiry services	> 90% of calls answered within 20 seconds.



QoS in Universal Service (II)

For each user:

- Automatic compensation to the user in case of non-compliance with the maximum supply time (60 days): 1 monthly fee per each month or fraction of delay.
- Automatic compensation to the user in case of interruption time greater than 24 hours/month.

QoS compromises in contracts

The contracts shall include compromises on QoS parameters:

- At least regarding maximum interruption time during a billing period (other compromises are optional).
- Compensation in case of non compliance.
- Procedure to make effective the compensation.

The Ministry publishes a summary including:

- Compromises from different operators.
- Corresponding compensation amounts.
- Procedure to make the compensation effective.
- Links to the providers' web pages.



Quality in billing systems

Mandatory for:

- Telephony service providers or electronic communications service providers whose billing system depends on time, volume or distance.
- With an annual gross income higher than 20 M €.

They shall:

- Implement a quality assurance system:
 - Based on ISO 9000 or equivalent standards.
 - Covering the whole tariff and billing process.
 - Compliant with quality criteria defined in the regulation.
- be annually audited by an independent third party.



Information in case of severe incidents

Definition: service disruption or severe degradation of telephony or Internet access services that:

- Affects more than 100.000 users or more than 25% of users in specific geographical areas (e.g. islands).
- Lasts longer than 2 hours (between 8:00 and 22:00).

Obligations:

- Inform the Ministry in less than 2 hours reporting on the nature, magnitude and possible causes of the incident.
- If the incident is not solved in a short time, report periodically updated information on the correcting measures adopted.
- Provide a final notification in less than 2 hours after the end.
- Provide a detailed report on the reasons, consequences, number of users affected and correcting actions adopted before 10 days.



QoS information for end users

- Objective: Provide users with relevant, comparable and up-to-date information on the QoS offered and provided by the main operators in the market.
- Obligated providers: Fixed telephony providers / Mobile telephony providers / Internet access providers with annual income higher than 20M €. Directory enquiry service providers with annual income higher than 2M€ (Voluntary for others).
- Obligations: Implement a QoS Measurement System: measure, publish and audit a set of QoS parameters, using common criteria.
- Role of SETSI (Secretaría de Estado de Telecomunicaciones y para la Sociedad de la Información):
 - Supervision and enforcement of the operator's obligations.
 - Inspect and, if needed, apply the regime of sanctions.
 - Publish information.

QoS information measurement

- Obligations:
 - Declare the QoS level offered by the service provider.
 - Measure the QoS level achieved by the provider according to the established methodology.
 - Implement and document the Measurement System.
 - Audit on a yearly basis:
 - By an independent third party.
 - Shall ensure that the implementation is according to the regulation.
 - Error < 5% in collected and published data.
 - Shall include data and procedures.
 - Submit to the MITYC a detailed and up-to-date documentation for the measurement system implemented.

QoS information publication

By operators:

- According to a common model:
 - Offered and achieved QoS level.
 - Summary of audit process.
 - Additional information.
- Free and ease to access information.
- Prior acceptance by SETSI. May be revoked.

By the SETSI:

- List of operators and web pages.
- Synthesis and comparisons of the data provided by operators (quarterly reports with weighted average data).



QoS parameters (I)

- Subset of ETSI EG 202 057, parts 1 a 4, parameters (end to end and user oriented) and additional requirements:
 - General:
 - Supply time for fixed access network
 - Supply time for Internet access
 - **Proportion of problems with number portability procedures**
 - Fault report rate per fixed access lines
 - Fault repair time for fixed access lines
 - Response time for directory enquire services
 - **Response time for admin/billing enquiries**
 - **Frequency of customer complaints**
 - **Customer complaints resolution time**
 - **Bill correctness complaints**
 - **Prepaid account credit correctness complaints**



QoS parameters (II)

- QoS parameters specific for PLMN:
 - **Service accessibility: Unsuccessful call ratio (radio access)**
 - **Service retainability: Dropped calls ratio**

- QoS parameters for voice services:
 - **Unsuccessful call ratio (end to end)**
 - **Call set up time**
 - **Speech connection quality**

- QoS parameters specific for Internet access:
 - **Successful log-in ratio**
 - **Unsuccessful data transmission ratio**
 - **Data transmission speed achieved**



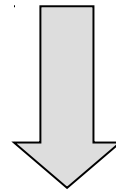
Commission for QoS monitoring

- Chaired by MITYC. Composed by service providers associations, users associations, S. U. designated operator and CMT representatives.
- Advise SETSI on QoS regulation development.
- Elaborate guides, additional requirements and QoS Measurement System upgrading.
- Working groups:
 - Fixed and mobile telephony services.
 - Quality in billing systems.
 - Internet access services.



Conclusions

- Relevant (main providers and services), comparable (ETSI parameters and additional requirements) and reliable (common methodology and audit process).
- Available to end users in operators' web pages (individually) and SESTI. Quarterly updated.



Transparency in QoS
Users can make informed choices



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General regulatory aspects

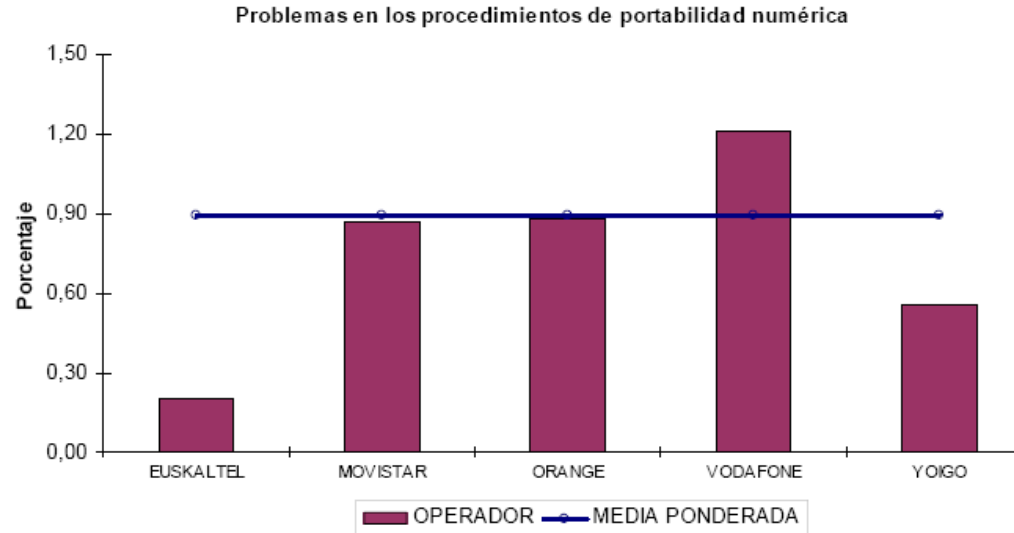
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Proportion of problems with number portability procedures

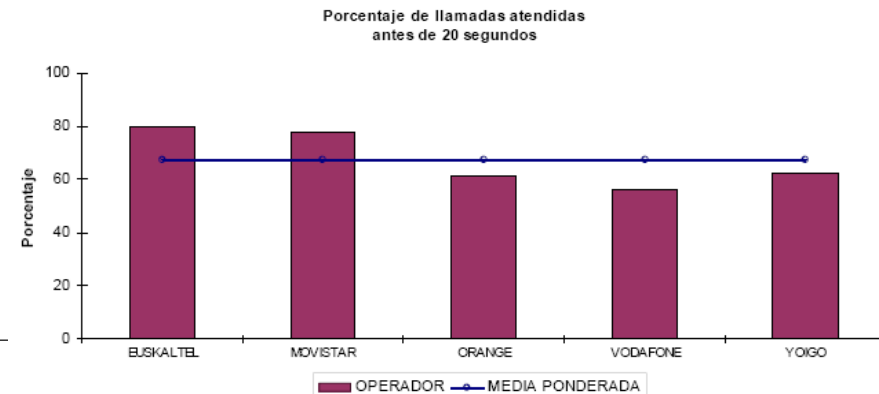
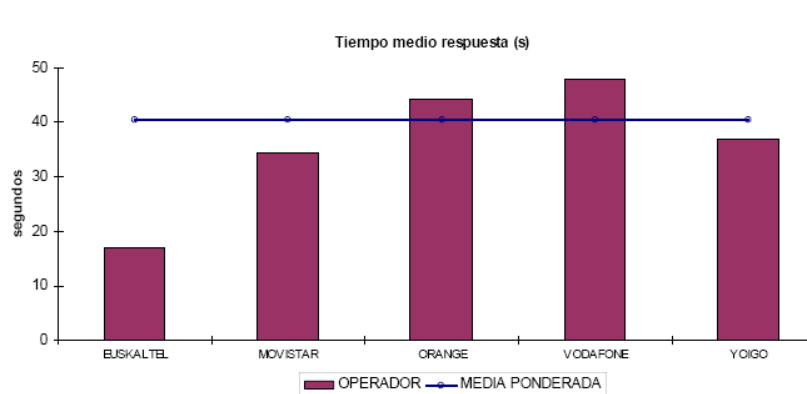
- Ratio of the number of issues related to number portability to the total number of number portabilities:
 - Issues logged by residential customers.
 - Role of recipient operator.





Response time for admin/billing enquiries

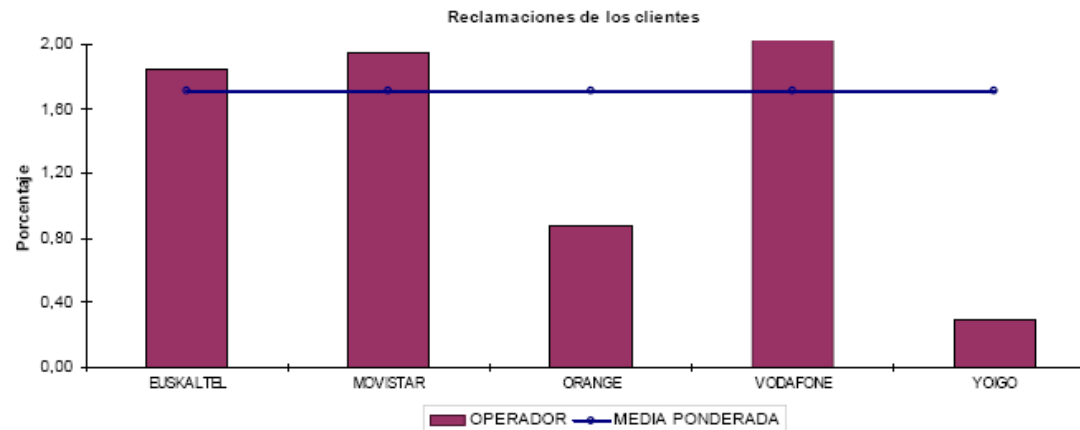
- Figures: Mean time to answer and percentage of calls answered within 20s:
 - MTA: includes informative messages duration.
 - PCA20s: Includes abandoned calls.





Frequency of customer complaints

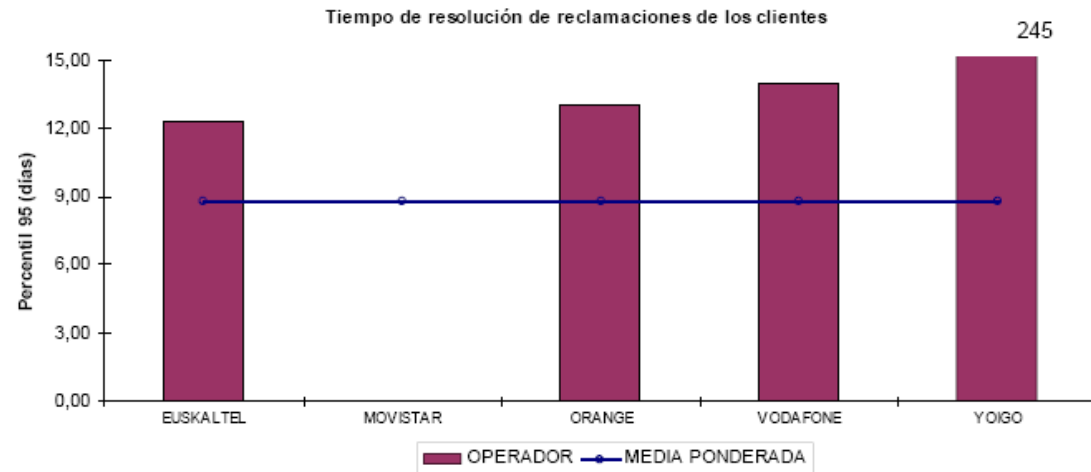
- Ratio of the total number of complaints to the average number of customers:
 - Differentiate between “complaint” and “information request”.
 - Complaints logged by residential customers (via phone, e-mail, Internet,...).
 - Specific treatment of repeated complaints.





Customer complaints resolution time

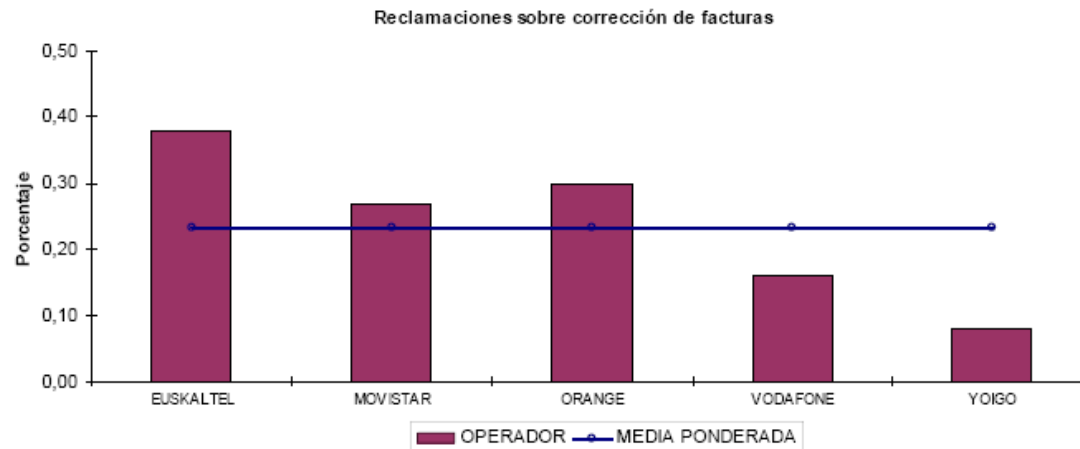
- Time by which the fastest 95% of complaints have been resolved:
 - Complaint resolved when solution is decided.
 - Specific treatment of repeated complaints.
 - Includes on-line and off-line resolved complaints.
 - Cases where customer requires a delay may be excluded.





Bill correctness complaints

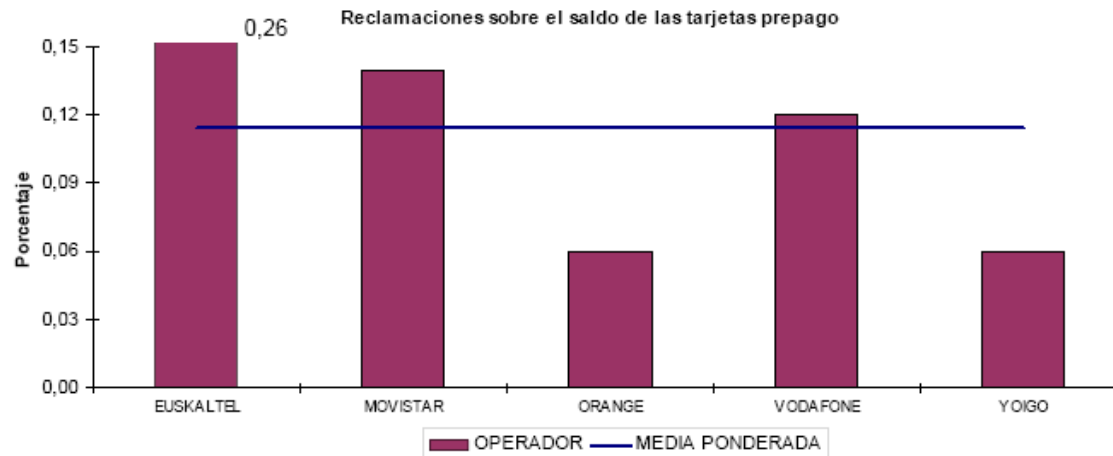
- Ratio of the number of billing complaints to the total number of bills:
 - Complaint: bill found inaccurate.
 - Complaints logged by residential customers.
 - Events not related to the service are excluded (PPV, terminals,...).





Prepaid account credit correctness complaints

- Ratio of the number of prepaid accounts credit complaints to the average number of prepaid accounts:
 - Complaint: account credit found inaccurate.
 - All active prepaid accounts (3 months).





QoS parameters specific for PLMN

- Defined in ETSI EG 202 057-3.
- Requirements: Reflect traffic variations accurately over time and locations (5% of relative accuracy).
- Alternatives :

Measurements based on network element counters:	Measurements based on test calls (drive-tests):
<p>Advantages:</p> <ul style="list-style-type: none"> • Include the effects of all calls. • Take account in changes of terminals. • Quality indicators valid for the whole network as well as for different regions. • Better comparability of congestion and network failures. 	<p>Advantages:</p> <ul style="list-style-type: none"> • Measurements from an external point. • Valid to check various parameters. • Comparability of results at the same point and time is high. • Locations without coverage are taken on account.
<p>Disadvantages:</p> <ul style="list-style-type: none"> • Technology dependent. • Cooperation by provider is needed to define the information collected. 	<p>Disadvantages:</p> <ul style="list-style-type: none"> • Very large number of samples is needed. • Not indicative of how users handle terminal. • Results valid for checked routes.



Service accessibility: Unsuccessful call ratio (radio access)

- Ratio of unsuccessful signalling and traffic channels assignments to the total number of attempts:
 - 2G: Complementary value to SDCCH (fixed factor) and TCH (BSC counters for Ericsson, Siemens, Nokia and Motorola) channels successful assignment ratio:

$$PLL F_{2G} = 100 \times \left(1 - \text{Successful_SDCCH_ratio} \times \frac{\sum \text{Successful}_{TCH}}{\sum \text{Attempts}_{TCH}} \right)$$

- 3G: Complementary value to RRC channels and RAB bearers, associated to voice calls, successful assignment ratio (RNC counters for Ericsson, Siemens, Nokia, Huawei and Alcatel-Lucent).

$$PLL F_{3G} = 100 \times \left(1 - \frac{\sum \text{Successful}_{RRC}}{\sum \text{Attempts}_{RRC}} \times \frac{\sum \text{Successful}_{RAB}}{\sum \text{Attempts}_{RAB}} \right)$$

- Weighted average for 2G and 3G values.



Service retainability: Dropped calls ratio

- Ratio of interrupted calls prior to their normal completion by the user to the total amount of successful calls:
 - 2G: Dropped TCH channels ratio (BSC counters from Ericsson, Siemens, Nokia and Motorola):

$$PLLI_{2G} = 100 \times \left(\frac{\sum Dropped_{TCH}}{\sum Successful_{TCH}} \right)$$

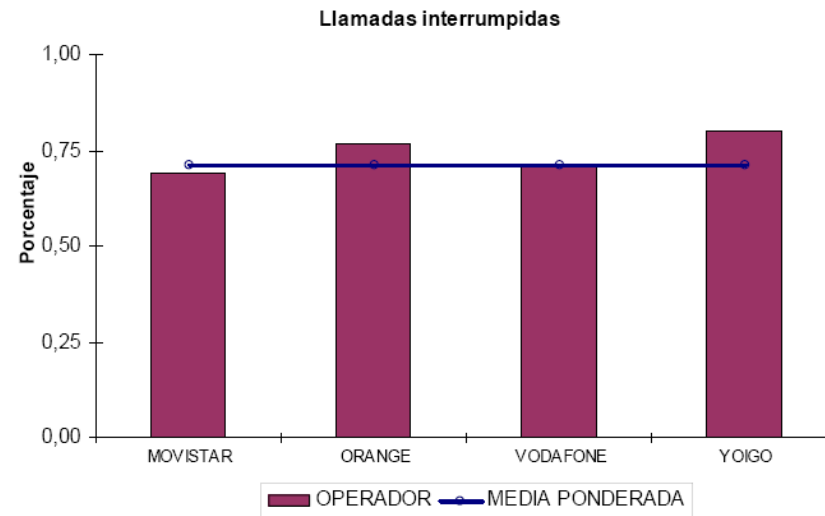
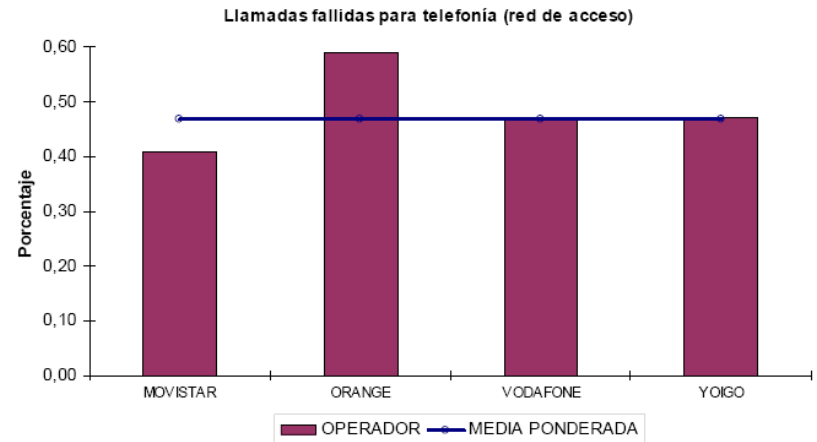
- 3G: Dropped RAB bearers, associated to voice calls, ratio (RNC counters from Ericsson, Siemens, Nokia, Huawei and Alcatel-Lucent):

$$PLLI_{3G} = 100 \times \left(\frac{\sum Dropped_{RAB}}{\sum Successful_{RAB}} \right)$$

- Weighted average for 2G and 3G values.



Results





QoS parameters for voice services (I)

- Defined in ETSI EG 202 057-2.
- Requirements: Reflect traffic variations accurately over time and locations (5% of relative accuracy).
- Alternatives:

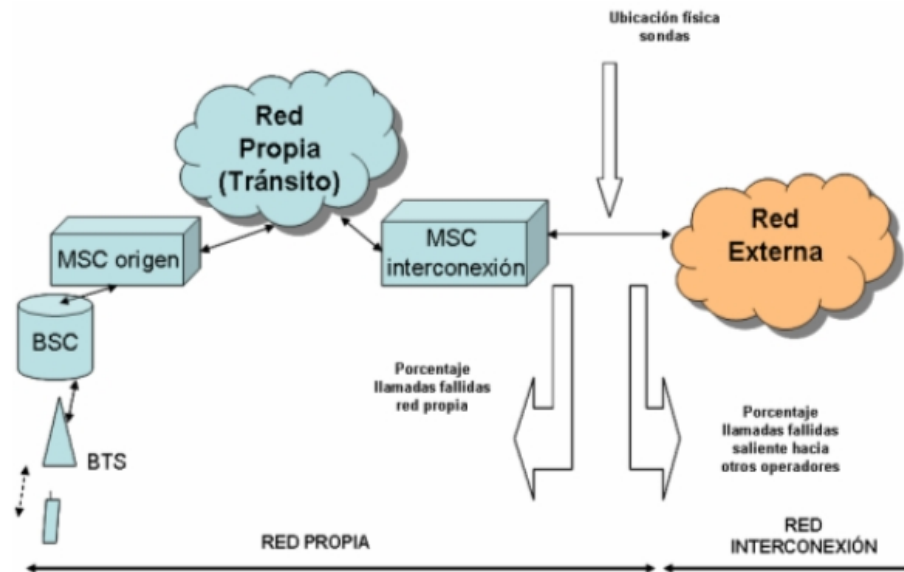
Measurements based on real traffic:	Measurements based on test calls:
<p>Advantages:</p> <ul style="list-style-type: none"> • Lower cost. • More representative. • No additional traffic generated. 	<p>Advantages:</p> <ul style="list-style-type: none"> • Measurements from an external point. • Valid to check various parameters. • Independent from provider. Third parties.
<p>Disadvantages:</p> <ul style="list-style-type: none"> • Technology dependent. • Cooperation by provider is needed to define the information collected. 	<p>Disadvantages :</p> <ul style="list-style-type: none"> • High cost of test and probes. • Intrusive traffic. • Results are valid only for checked configurations.



QoS parameters for voice services (II)

General methodology:

- Passive probes in POI monitoring all real traffic.
- ISUP signalling. Cause values as in ETSI guide Annex D.
- Appropriate adjustment for radio access.
- Destination: national calls, international calls and mobile.

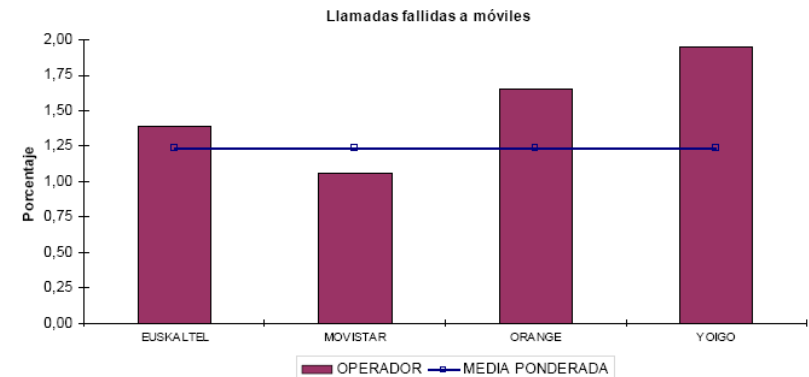
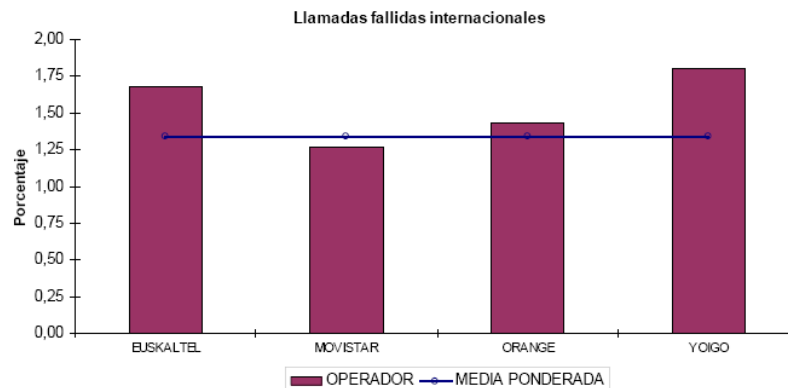
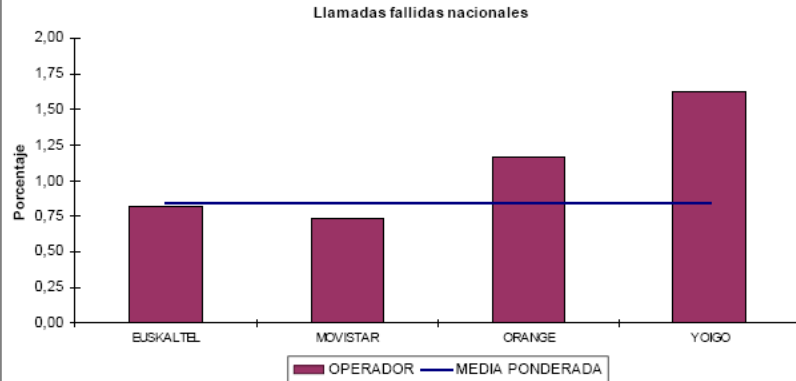




Unsuccessful call ratio (end to end)

- Ratio of unsuccessful calls to the total number of attempts.

$$UCR_{Total} = UCR_{UE-POI} + (1 - UCR_{UE-POI}) * UCR_{POI-Destination}$$

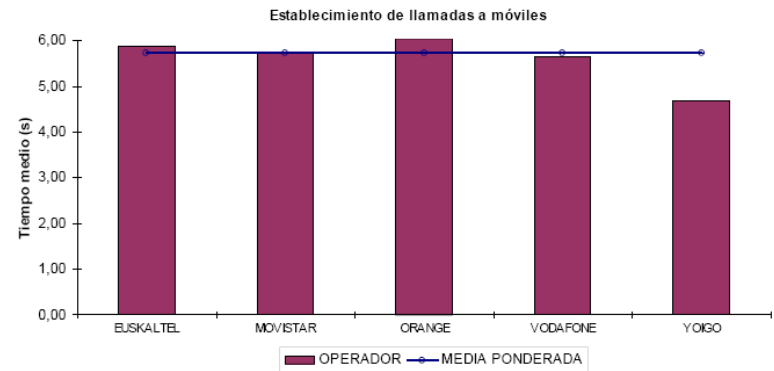
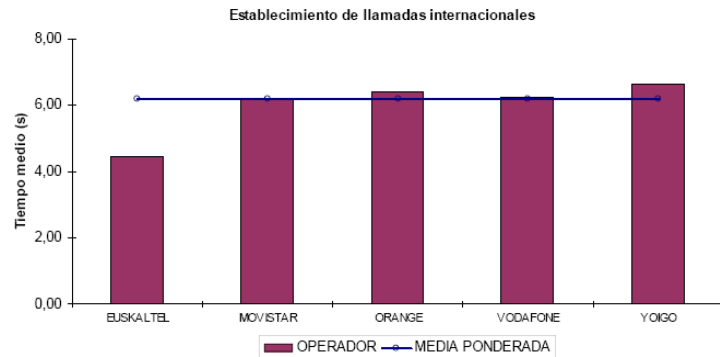
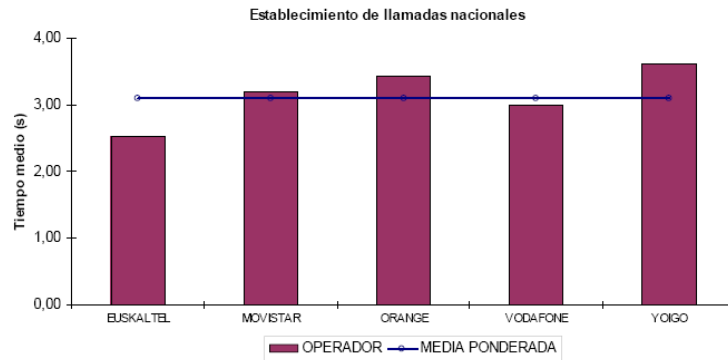




Call set up time

- Mean time to establish a call. Equivalent to PDD.

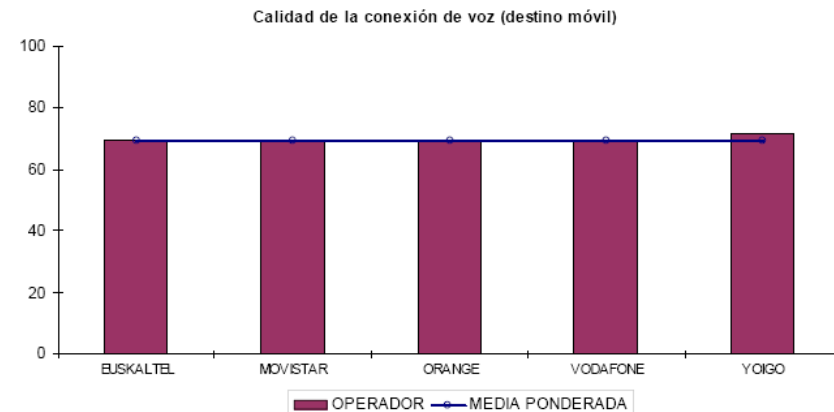
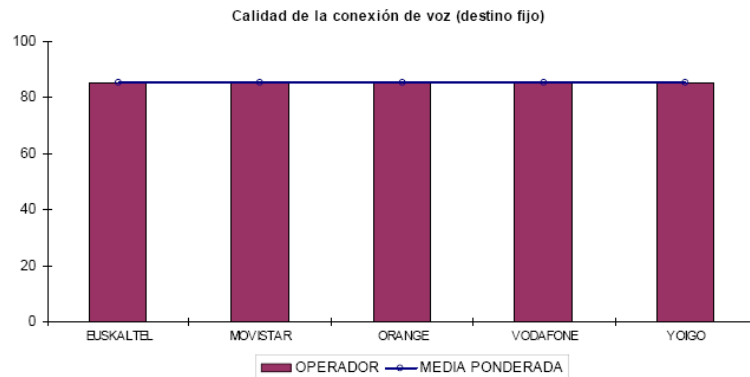
$$CSU_Time_{Total} = 2s + CSU_Time_{POI-Destination}$$





Speech connection quality

- Measurement alternatives: intrusive methods (test calls), non intrusive methods (passive probes) and parametric models (E-Model).
- Calculates R factor (Defined in Rec. UIT-T G.107):
 - Based on network design (area covered by MSC, type of codec,...).
 - Common set of terminals and reference connections.
 - Evaluates delay, distortion, impairments, echo,...





QoS parameters specific to Internet access (I)

- Defined in ETSI EG 202 057-4 (test calls).
- Mirrors additional requirements for fixed networks:
 - Only relevant technologies: those that individually account for more than 10% of the market and (if needed) those that aggregate 85% of the market (HSDPA since 2009).
 - Only relevant services: within each operator, those that individually account for more than 10% of their customers and (if needed) those that aggregate 85% of the customer's base.
 - Coverage for the measurement system: > 90% of customers.
 - Number of test probes: from a minimum of 1 test probe in regions between 25.000 and 50.000 customers to a minimum of 5 test probes in regions with more than 400.000 customers. Regions with less than 25.000 customers can be aggregated.
 - Tests from fixed locations.
 - Periodicity of measurements: at least every 20 minutes.
 - Average of the measurements collected during the period weighted according to the traffic pattern.
- Specific additional requirements:
 - Active customer: Downloading > 5 Mbytes (web access or Internet content) in a quarterly basis.
 - Average received power for test probes: < -78 dBm.



QoS parameters specific to Internet access (II)

- Figures:
 - Successful log-in ratio: IP address and DNS resolution < 15s.
 - Successful data transmission ratio: Download of a test file 4 times the size (in kbit) of the theoretically maximum speed (in kbit/s) and error free < 30s.
 - Data transmission speed achieved: Ratio of the downloaded data to the elapsed time:
 - Average speed.
 - Maximum speed (maximum of 95% of the lowest download speeds).
 - Minimum speed (maximum of 5% of the lowest download speeds).
- Published results:
 - By end 2010.



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Thank you !!!

José Antonio Rodríguez Álvarez
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