QoS Monitoring and Compliance

DAY 3

REGULATORY TOOLS FOR QOS ENFORCEMENT

1. General Regulatory Aspects of QoS
2. Regulatory Technical Parameters
3. Regulatory Policy Challenges

Guidelines on Regulatory Aspects of QoS

- The objective of the guidelines: to assist regulators or administrations to achieve desired levels of QoS for ICT services under their jurisdiction
- Scope of the guidelines:
  - end-to-end QoS as perceived by the user when using modern mobile and broadband services.
  - correspondingly be used for traditional wire-bound and legacy services.





Global Regulatory challenges

- Move from legacy to IP networks
- Standards Development Organizations
- Network Equipment Manufacturers
- Terminal Device Manufacturers
- Network Operators and Service Providers
- Regulators and Administrators





Move from Legacy to IP Networks

- Move from traditional networks to Integrated (transport) services delivering all (transport) services via a single network access point,
- An access network and a unified backbone, making pre-defined transmission planning of QoS a major challenge.
- Modern packet-based network quality parameter requirements are much more undefined giving the impression is that the responsibility for end-to-end QoS has been lost;
- IP networks cannot provide for self standing end-to-end QoS, but only transport classes, which enable QoS differentiation.





Standards development organizations

- ITU-T , European Telecommunications Standards Institute (ETSI), Internet Engineering Task Force (IETF), have the collective knowledge and expertise on QoS but fcae difficulty in harmonization of QoS Standards.
- SDOs are contribution-driven,
- Industry Stakeholders:
  - mainly rely on industry standards instead of globally recognized standards,
  - may keep control of their intellectual property
  - may not invest resources in globally recognized standards,
- The SDOs may only try to convince industry leaders, for example, in dedicated events such as conferences.








Network equipment manufacturers

- Rely on the QoS related performance requests (of network and system functions) from network operators and service providers.
- Participate in the QoS work of SDOs in order to standardize the QoS and performance requirements between several parties.
- For many there is no visible incentive in the short-term to participate in the work of SDOs related to end-to-end QoS.
- The return of investment (RoI) from engagement in SDOs activities not readily visible.

Terminal device manufacturers

- Confronted with a mass market
- The acceptance of terminals in the market is based on other factors rather than end-to-end QoS
- The acceptance of the terminals based on:
  - price,
  - other functions like MP3 players, GPS, etc.
  - applications available like games, etc.
  - brand and artifacts e.g. "kids prefer the pink phone!"





Network operators and service providers

- Faced with the necessity of huge investments in both infrastructure and access technology.
- Likely to react partially by investing in new capacity, and partially by rationing existing capacity.
- Prefer use of traffic management tools for increasing the efficiency with which to manage existing network capacity rather than expansion.
- May use traffic management as a method towards suppressing competition from the "un-managed" Internet (i.e., not differentiating between traffic types, source or destination points)
- Their actions raise the Net Neutrality concerns





Network operators and service providers

- Inhibit content or application providers with which it competes from introducing new innovative products.
- May aim at providing services on top of the bit stream.
- Claim that "guaranteed QoS" (which is only a statistical guarantee) requires service differentiation in the networks;
- Prefers a traffic class differentiation, requesting a certain transport class from the network with different services.








Regulators and Administrations

- Responsibility to consumer protection being affected by the rapid introduction of vendor-specific new services.
- Required to strike a balance between service competition and infrastructure competition to address the challenges associated with QoS on the networks.
- Assume it is still fairly easy for the new technology to provide QoS not less than in the ISDN era;
- Lose the overview of proprietary services provided by various NOs and SPs "on-net" and the offered QoS.
- The services are not standardized, thus for interconnection scenarios need specific service agreements for each network-to-network-interface (NNI).




Regulators and Administrations

- Recognise that the un-managed Internet has led to the creation of new services offered "over the top" (e.g., Skype),
- OTT is an important factor contributing to the economical benefits of countries;
- Services on the Internet can be created, improved, judged and used by each individual within the legal context without restrictions.




Regulators and Administrations

- The packed-based backbone of the NO providing proprietary services
- NO carriage open to Internet traffic may give lower priority to the open Internet traffic due to inherent low revenue.
- The discrepancy between advertised and actual delivery speeds of the network.
- The need for clear and transparent communication of QoS parameters and network management practices





Summary: Regulators and Adms

- Operators and ISPs often declare traffic management techniques and policies used, presented in a highly technical way which does not explain the 'real world' effects for consumers to act upon such information.
- Consumers may not be able to detect the actual applications of discriminating traffic management techniques





Summary: Regulators and Adms

- Consumers find it difficult to distinguish between the effects of traffic management techniques on QoS from the effects of other quality degrading factors.
- A consumer observing that traffic is routinely throttled may not know whether this is done by intention, or is caused by other factors such as network congestion, which is leading to the degradation of service.
- It is therefore important for the regulators and administrations to monitor the effectiveness of transparency and QoS.

Global Challenges Summary

- Dramatic increase in mobile communication,
- Increase in both in terms of the number of registered devices and of the volume of requested resources.
- Migration scenarios and hybrid connections with existing wire-bound and traditional networks and terminals may be neglected
- Appropriate QoS standards may not be established or enforced.





Global Challenges Summary

- Service differentiation in modern packet based networks is facilitated with, e.g., the IP Multimedia Subsystem (IMS), which in its QoS part is basically a resource allocation tool.
- The exact services are not defined or standardized which makes IMS less flexible for services to be offered across multiple packet networks.
- IMS is under the sole control of the 3rd Generation Partnership Project (3GPP),
- 3GPP is not an SDO in the classical sense and its influence on the further development of IMS for ITU members is very limited.





Regulatory Technical Parameters

- Speed (data throughput) of the access network
- Congestion in the backbone
- End-to-end delay (latency)
- Delay-variation (jitter)
- Packet loss (loss of information).

Regulatory technical challenges

- These parameters have multiple facets depending on which kind of gateways are used to interconnect IP networks:
- Jitter is the variation in delay between different packets
- Jitter compensation (by de-jitter buffers) converts jitter into an additional delay which may build up and increase to unacceptable values;
- Packet loss may be concealed to an extent where essential information is lost.
- Bad terminal implementations may destroy reasonable performance delivered from the network(s);
- Users not be able to judge the difference in end-to-end QoS.





Regulatory policy challenges

- Need to consider new approaches to anchor national strategies or regulatory frameworks around the multi-faceted concept of QoS,
- Set and keep the right balance between service and infrastructure competitions
- Address the challenges associated with QoS on the telecommunication network





Regulatory policy challenges

- Provision of adequate QoS by network operators and service providers that claim the need a certain traffic management over increasingly congested networks
- Data restrictions, traffic throttling, filtering and/or the use of data caps of thresholds
- Cases where by "Internet access" provided to customers is no longer Internet access, but a service provided by the ISP
- Implications of reduced speed
- Unsolicited services, e.g., entering wrong URLs
- Service restrictions




Selecting appropriate regulatory approach

- Options and principles
  - Alternative approaches
  - Regulatory approach
  - Customer oriented approach
  - Market regulations




Four possible elements in a regulator's approach to QoS:

- Obtaining appropriate information on the level of QoS and identifying the problem areas: without the appropriate information the other elements cannot beundertaken;
- Publishing information on QoS performance for customers to be better informed;
- Imposing regulations on performance such as required minimum levels and fines or compensation;
- Undertaking a constructive dialogue with the operator concerned to encourage and foster improvements.








Alternative approaches:

- A regulation orientated approach:
  - Reporting is to the regulator;
  - Performance targets are set in regulations;
  - Fines are payable to the regulator if targets are not achieved.
- A customer orientated approach:
  - Reporting is to the customer;
  - Targets and minimum performance levels are given in contracts;
  - Compensation for poor performance is payable to the affected customer.

Applicability of alternative approaches

- In the early stages of market development:
  - the regulation orientated approach may be more appropriate
  - if the performance is poor and the focus is on achieving a basic minimum level of performance.
- In a later stage of development:
  - the customer orientated approach may be preferable
  - the regulator can reduce its involvement and the operator is pushed to have a closer relationship with the customer.








Setting performance targets

- Setting performance targets needs to be treated with care and the distinction between the minimum level of performance and the desired level needs to be maintained clearly.
- There is a risk that if there is a minimum level of quality specified in a market with little competition, then this will be regarded as an acceptable level.
- It might be better either not to set a target at all and just to report achieved performance levels, or to set two levels – a minimum and a desired level.

Implications of Regulations

- QoS regulation has a cost and the costs should be assessed against the benefits.
- Efforts should be focused where there are known problems and problems areas change so there needs to be some flexibility.
- The same level of effort, e.g., the same requirements for measurement and reporting should not be applied to all possible parameters as this is needlessly expensive.
- Highest effort levels should be focused on parameters that are both important to customers and where performance is poor or most at risk.








Legal System Requirements

- Legal system should allow regulations to include some scope for subsequent decisions
- Should allow determinations by the regulator without needing to go through the whole procedure for revising a regulation.
- The regulation could include a clause such as "The regulator may revise the list of parameters, target levels or reporting requirements in the future by giving 3 months written notice to the operators".




Principles for selecting parameters

- Parameters to should relate to the aspect of services that have the biggest impact on users;
- Parameters should be well defined and be cost-effective to operators.
- Parameters , as far as possible, should have methods of measurement that are already in use by the operators.
- Parameters should reflect differences in services and geographic areas but should be consistent between services.




Principles for selecting parameters

- Measurements to be published should relate to aspects of services that users experience directly (not the underlying technical cause).
- Publications should reach beneficiaries easily understood without being misleading.
- Publications should allow for comparison between operators.
- Targets set should relate to the quality users want.
- Targets should avoid limiting customer choices between quality and price.
- Values need to be determined through sufficient information such as earlier measurements by operators, used in other countries or proposed in international standards.



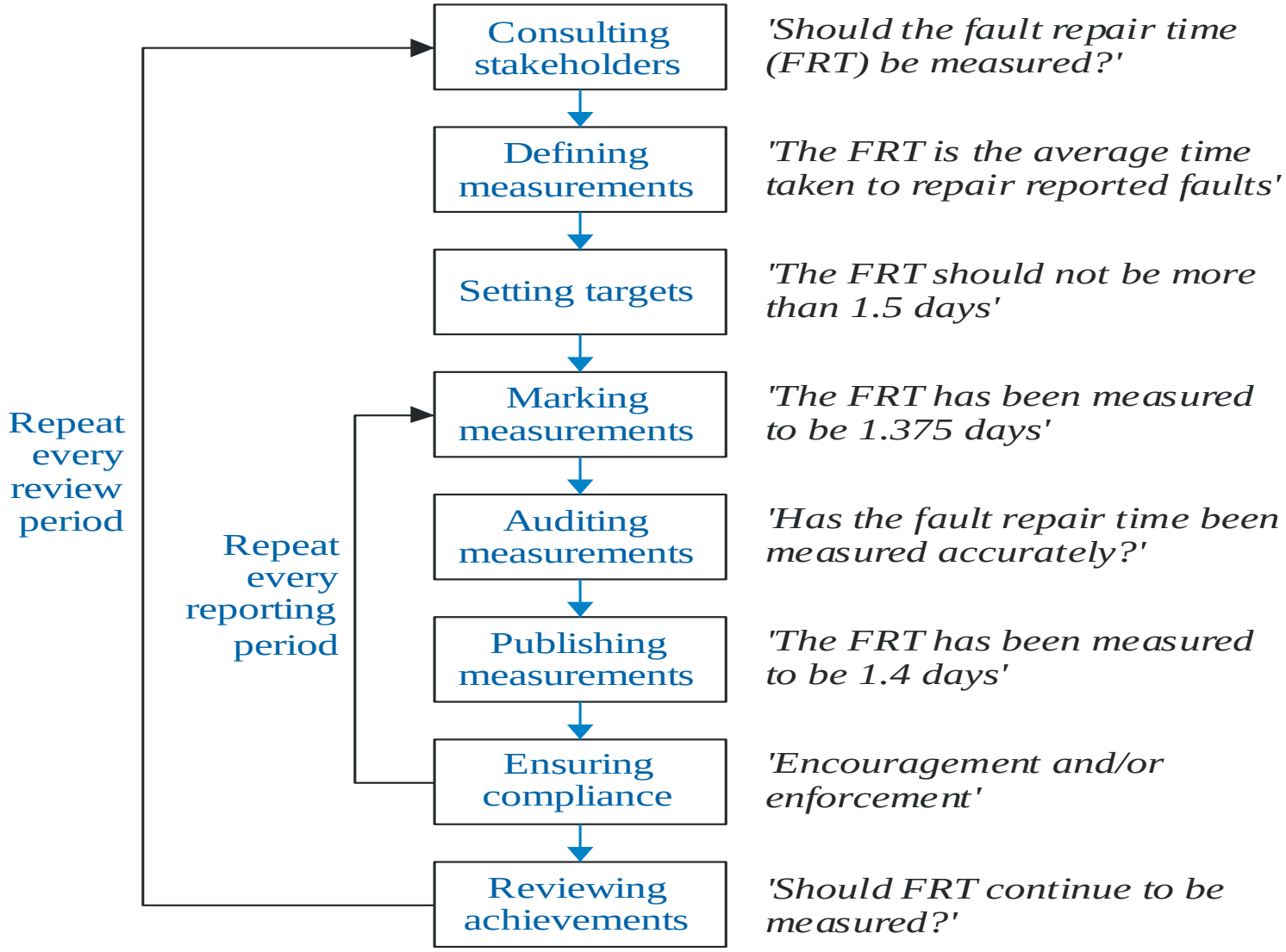


Activities in QoS regulation

- Activities in relation to quality of service regulation that emphasize the institutional and operational aspect of these activities:
  - Defining parameters:
  - Setting targets:
  - Making measurements:
  - Auditing measurements:
  - Publishing measurements:
  - Ensuring compliance:

Activities in QoS Regulations



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Measurements of a parameters

- Some variations of standard parameters may be necessary depending on the specific situation in a country or sector.
- The measurements of a parameter might need to distinguish between:
- Market segments: QoS may be different for private consumers, small and large businesses or for wholesale and retail offerings.
- Reporting areas: areas with likely differences in quality, such as rural and urban areas.

Measurements of a parameters

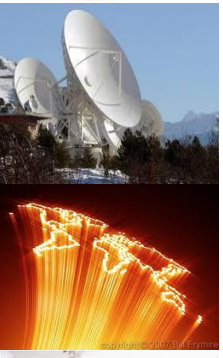
- Operators: with few customers, that resell services from other operators or that are not dominant in the market might be exempted from monitoring parameters or publishing measurements.
- Doing this could reduce inconvenience and costs. It is recommended that setting targets would be mainly necessary with dominant operators, whereas for other operators competition should help to reach the same results.
- Services: Parameters may be specific to services such as voice, text messages and Internet, television and radio broadcasting as well as leased lines as the main services that have most impact on users.
- However, it is recognized that even this list may be too long and it may not always be desirable or necessary to impose quality of service regulation on all these.





Defining Parameters

- When defining parameters, the involvement of operators is beneficial and desirable.
- It has to be noted that there is a risk that operators may exercise undue influence and that the consultation process can be lengthy.
- The regulator needs to exercise strong leadership while ensuring that stakeholders are consulted.





Defining Parameters

- The following factors, among others, should generally be taken into consideration:
  - The practicability for operators to make the required measurements;
  - The practicability for regulators or any independent entity to audit the results;
  - The measurement being made should retain the customer experience aspect.

Setting targets

- Targets are normally set by the regulator based on consultation and prior monitoring of an operator's data.
- The report points to the possibility that the operators could also set their own targets and be obliged to publish their targets.





Making measurements:

- "customer interface" and "network infrastructure" parameters, measurements are conveniently made by operators,
- Many "service functionality“ parameters are best made by external measurement agencies or by users to allow for comparison and reduce the cost of measurements.









Auditing measurements:

- Measurements could be signed off by senior employees in a "self-certification" process,
- Measurements could be audited by external agencies including independent auditors or checked by regulators themselves.
- Important considerations are costs (for both the regulator and the operator) and the effectiveness of audits.

Publishing measurements:

- Measurements should be published by the regulator to help with comparisons between operators.
- To simplify the task the number of measurements to be published could be reduced.





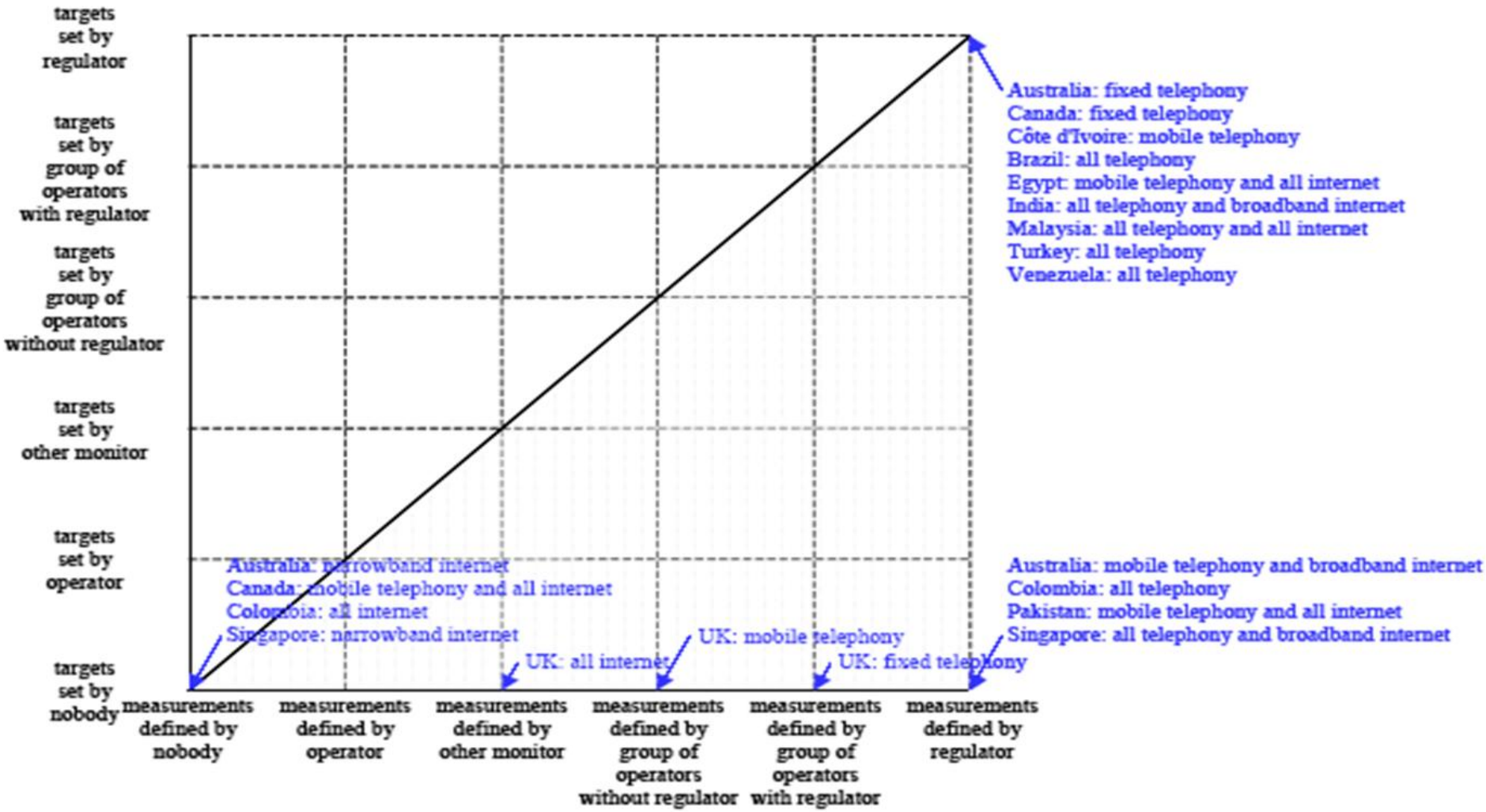




Ensuring compliance:

- The regulator may start with recommendations and move towards obligations if the recommendations are important and practical, but the operator is not willing to take part.
- A range of techniques the regulator can adopt:
  - "naming and shaming" strategies
  - to tighter regulation,
  - financial penalties and
  - finally more drastic legal enforcements.
- As a general principle, it is recommended that encouragements and enforcements should be graduated and proportional.

Enforcement of QoS Regulations






Parameters and targets

- QoS regulation can have several aims that justify it; some are more important when competition is strong, and others are more important when competition is weak.
- The aims are:
  - Helping customers to make informed choices
  - price is an important factor in choosing a service, but once customers have settled on the price they want the best quality available at that price.

Parameters and targets

- Quality can be more important than price, especially for business customers, because problems with quality are more likely to be costly.
- For services that are bundled together, with one price covering several services, the quality of specific aspects of the services can influence choices greatly.

◦ Checking claims by operators:

- Operators sometimes make claims in advertisements about their services or the services of their competitors.
- Publishing quality levels can enable people to check claims by operators about their services or services of their competitors to ensure accurate claims.





Parameters and targets

- Understanding the state of the market:
- To show how well policies are succeeding:
- Monitoring and publishing quality levels can show gaps in performance that could be filled by market entry or by gaps that need new policies for particular groups of people, geographic areas or operating conditions (such as emergencies).
- Maintaining or improving quality in the presence of competition
- Publishing quality levels and having targets can help to maintain quality in cases of price cutting that leads to cost cutting and reduction of quality.








Recommended Regulation approach

- Information gathering and selection of parameters
- Information publication
- Target levels
- Penalties
- Constructive dialogue

Information gathering and selection of parameters

- Regulators' combined approach:
  - Listening for problems through the press,
  - Occasional meetings with the public;
  - Monitoring the complaint statistics of the operators;
  - Requiring regular reporting against parameters with both high importance and high risk.





Information gathering and selection of parameters

- Taking into account of the costs of monitoring and reporting.
- A "light touch" approach:
  - pushing the SPs closer to the consumer on issues where there are problems
  - Avoiding an excessive burden of reporting against all possible parameters.





Information publication

- Regulators should publish information on performance on its website
- Require the operators to send the information periodically to subscribers with their bills.
- Any information should be easily accessible as possible.








Setting Target levels

- Setting target levels is probably the most difficult aspect of QoS regulation.
- Based on both an understanding of what the customers require and what the operator can reasonably be expected to provide.
- Setting a minimum level below which compensation is payable and
- Setting a desired level for achieving good customer satisfaction.





Penalties

- In general, ensuring compliance is highly recommended in QoS regulation.
- Two geral approaches in implementing quality of service regulations:
  - an encouragement and
  - enforcement approach.
- Fines are generally tied to licence obligation to be agreed on by the regulator and operator.
- Enforcement approach:
  - start with recommendations and
  - move towards obligations if the recommendations are important and practical.




Penalties

- Range of penalty techniques,:
  - start with "naming and shaming“ strategies
  - tighter regulation,
  - financial penalties
  - finally more drastic legal enforcements.
- Can involve extensive legal processes and may take a long time.
- A schedule of penalties may be gazetted to ease implementation.

Penalties

- It is recommended
  - encouragements and enforcements should be graduated and proportional.
  - Compensation should be payable to customers who are affected by particularly poor performance.
- Compensation should be addressed through SLAs in contracts where the agreements have to be approved by the regulator.
- SLAs should be introduced only where there is some stability in supply.
- SLAs should not be used for new services and new technologies until a reasonable level of experience has been gained with the technology.








Penalties

- Initial levels of compensation should be low;
- The levels of compensation should rise depending on the extent on the problem
- Higher payments to business customers than to residential ones.
- For example: failure to repair a fault within a specified time would incur a penalty of say USDX per day but this rate should not be capped at a maximum of say 5 days but continue and possibly the rate per day should rise if the time exceeds say 10 days.




Constructive dialogue

- What is the difference between a dialogue and a discussion?
- Whenever feasible, the regulator should engage in constructive dialogue with the operators about quality problems.
- Constructive dialogue is not a process of telling the operator how to run their business.
- A process of asking penetrating questions that will have make the operators to review and reconsider their approach in areas with specific problems.

Service level agreements

- The inclusion of "service level agreements" in contracts has become popular
- SLA agreements not always effective because:
  - the formulation may be vague and
  - compensation terms may not be stated.
  - the process for claiming compensation may be excessively complex to deter claims.
- Effective a service level agreement should state:
  - The minimum level of performance offered to the customer,
  - Not the average level to be achieved for all customers.
  - The compensation payment if the minimum level is not achieved with the sum at least proportional to the degree of failure.
- The mechanism for claiming compensation:
  - compensation should be paid automatically
  - the customer should not be required to make a claim.





Service Quality Agreement Structure

Source: ITU-T Rec. E. 800

Specifying Parameters

- Easily understood by the public, and be useful and important to them.
- All parameters applicable at the network termination point.
- Measurements made on the customer's premises, using in-service lines.
- Real traffic rather than test calls should be used as a basis of the measurements, wherever possible.
- Parameters should be capable of verification by independent organizations.
- This verification might be made by direct measurements or by audit of the operator's measurements.









Specifying Parameters

- The accuracy of QoS parameter values should be set to a level consistent with cost-effective available measurement methods.
- The parameters designed for both statistical and individual application.
- The statistical values derived by the application of a simple statistical function to individual values.
- The statistical function should be specified in the standard.
- The standard should contain guidelines on how statistically significant samples should be selected.

Specifying Parameters

- Making tests from the network termination point is normally not practicable.
- The definition of parameters needs to take account of all the possible customer circumstances and this is not easy.









Specifying Parameters

- Definition needs to exclude circumstances where the definition in not appropriate.
- Definition should measure what will be perceived as good quality.
- Definitions not to allow circumstances where the metric is good but the performance is poor, or vice versa.
- For example, for a customer who specify the date of provision a new connection, the important measure is whether the work is carried out on the date requested.

Specifying Parameters

- In some cases, it may not be possible to develop a suitable definition;
- In case of no suitable definition, it is better not to require reporting than to require reporting against an inappropriate definition
- An example of list of proposed parameters is given below:








List of proposed parameters

Customer interface	Network infrastructure	Service functionality
1. Customer complaint submission rate	4. Coverage	8. Call set up ratio
2. Customer complaint resolution time	5. Service supply time	9. Call retention ratio
3. Customer service call answer ratio	6. Fault report submission rate	10. Listening voice quality
	7. Fault repair time	11. Value added service call answer ratio
		12. Message transmission ratio
		13. Packet transmission ratio
		14. Packet transmission





Formulation of the target levels

- The levels for aggregated performance involving a number of different observations can be formulated in two different ways:
  - The percentage of events that exceed or fail to meet a target level of performance (e.g., % lines delivered in more than X days). In this case, X indicates a target level.
  - The number of days within which 90% of lines were delivered. In this case, no target level is indicated.
- If compensation is going to be given, then the measure must have a simple pass or fail criterion for each individual customer




Measurement methods

- Measurement methods if possible should be objective.
- For some issues such as the effectiveness of call centres and help lines it may not be possible to specify a parameter that can be measured objectively
- Subjective user assessments are done by asking the caller at the end of the call to assess its effectiveness on a scale of 1-5.

Measurement methods

- Some measure of performance may not be suitable for the application of penalties or compensation.
- Measurement may be taken by third parties or reported by the operator itself.
- Measurement may be based on sampling or include all events.
- Measurements inbuilt into the network or support systems are automatic, self-reporting and covers.
- If sampling is used, consideration to be given to specifying criteria for the sample to be representative and comparable between networks.








Reporting

- Reporting normally involves aggregated results. The question is whether they should be aggregated over:
  - All parts of the network or aggregated separately for different areas;
  - All customer types or reported separately for say business and residential customers.
- Decided on a case-by-case basis taking account:
  - the local circumstances and
  - quality problems.