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ICT Quality of Service Regulation: Practices and Proposals

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Agenda

- The motivation for QOS monitoring
  - Why QOS monitoring is done
- The operational arrangements for QOS monitoring
  - How QOS monitoring is done
- The selection of areas of focus for QOS monitoring
  - What QOS monitoring is done

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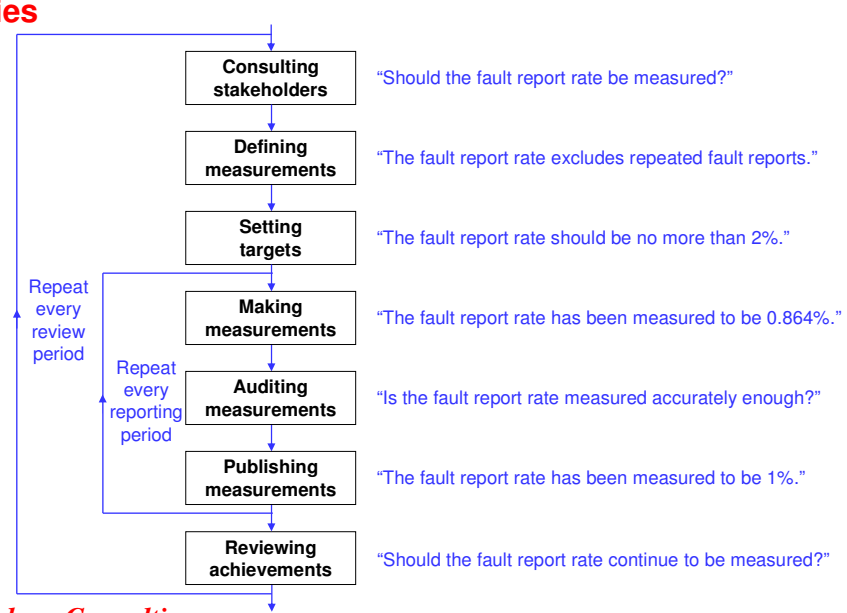
Quality of service monitoring: activities



Quality of service monitoring: aims of regulators

- Helping customers to make informed choices.
- Checking claims by operators.
- Understanding the state of the market.
- Maintaining or improving quality in the presence of competition.
- Maintaining or improving quality in the absence of competition.
- Helping operators to achieve fair competition.
- Making interconnected networks work well together.

Quality of service monitoring: divergences between aims

- Different aims can suggest different emphases in activities:
  - Helping customers to make informed choices is important mainly when choices are inconvenient or costly to change.
- Different aims can suggest different services for monitoring:
  - Helping operators to achieve fair competition might involve imposing targets on wholesale services but not on retail services.
- Different aims can suggest different treatments of operators:
  - Resellers might not make measurements but might publish measurements made by the original operators.
- Different aims can suggest different measurements:
  - A single indicator of customer satisfaction might help potential customers but not other operators or policy makers.

Quality of service monitoring: contributions of activities to achieving aims

Activity	Monitored operators	Aim						
		Helping customers to make informed choices	Checking claims by operators	Under-standing the state of the market	Maintain-ing or improving quality in the presence of comp-etition	Maintain-ing or improving quality in the absence of comp-etition	Helping operators to achieve fair comp-etition	Making inter-connected networks work well together
Making measure-ments	Dominant operators only							
	All operators			+				
Publishing measure-ments	Dominant operators only					+		
	All operators	+	+		+			
Setting targets	Dominant operators only					+	+	+
	All operators				+			
		Retail and wholesale services	Retail services	Retail and wholesale services	Retail services	Retail services	Wholesale services	Retail and wholesale services

Quality of service monitoring: benefits of activities to stakeholders

Activity	Monitored operators	Stakeholders		
		Policy makers	Customers	Other operators
Making measure-ments	Dominant operators only			
	All operators	+		
Publishing measure-ments	Dominant operators only		+	
	All operators		+++	+
Setting targets	Dominant operators only	+	+	++
	All operators		+	

- **Making measurements for all operators could benefit policy makers.**
  - **Making measurements is not enough on its own.**
- **Publishing measurements for all operators could benefit customers.**
  - **Publishing measurements is not easy to do well.**
- **Setting targets for dominant operators could benefit other operators.**
  - **Setting targets for all operators could constrain innovation in services.**

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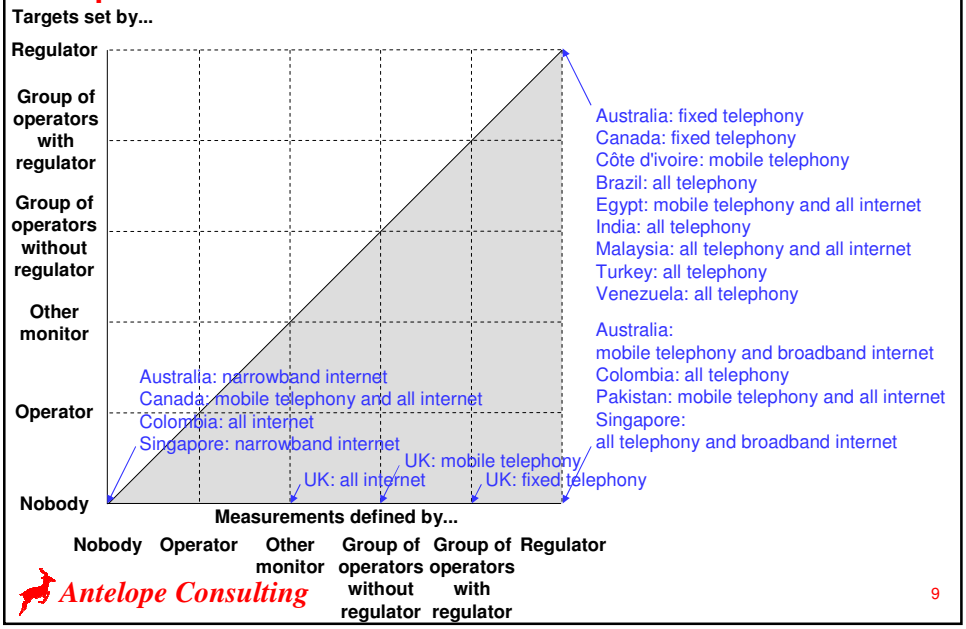
Organisations defining measurements and setting targets: example countries



Organisations defining measurements and setting targets: example countries

Activity	Monitored operators	Responsible organisation					
		Regulator	**Group of operators with regulator**	**Group of operators without regulator**	**Other monitor**	**Operator**	**Nobody**
Defining measure-ments	Dominant operators only	Canada: fixed telephony					
	All operators	India: all telephony Spain: fixed and mobile telephony	Chile (formerly): all internet France:mobile telephony UK: fixed telephony	UK: mobile telephony	UK: all internet		
Setting targets	Dominant operators only	Canada: fixed telephony Spain: fixed telephony					
	All operators	India: all telephony	France:mobile telephony				UK: all telephony

Organisations defining measurements and setting targets: comparative disadvantages

Activity	**Monitored operators**	**Responsible organisation**					
		Regulator	**Group of operators with regulator**	**Group of operators without regulator**	**Other monitor**	**Operator**	**Nobody**
Defining measure-ments	**Dominant operators only**	Does not use skills of operators.	May be slow to conclude.	May not look at all aspects. May be slow to conclude.	May not look at all aspects. Does not use skills of operators.	May be self-serving. Does not provide fair comparisons.	Does not achieve any quality aims.
	All operators						
Setting targets	**Dominant operators only**		May be slow to conclude. Limits service offerings.	May be slow to conclude. Limits service offerings.	May not look at all aspects. Does not have commitments by operators.	May lead to poor retail and wholesale quality.	May lead to poor retail and wholesale quality.
	All operators	Limits service offerings.					

Organisations making measurements, auditing measurements and publishing measurements: example countries

Activity	Monitored operators	Responsible organisation					
		Regulator	Group of operators with regulator	Group of operators without regulator	Other monitor	Operator	Customer
Making measure-ments	Dominant operators only					Canada: fixed telephony	
	All operators	France:mobile telephony India: mobile telephony Spain: mobile telephony	UK: fixed telephony	UK: mobile telephony	UK: all internet	India: all telephony Chile (formerly): all internet	Chile (formerly): all internet
Auditing measure-ments	Dominant operators only						
	All operators	India: all telephony	UK: fixed telephony	UK: mobile telephony			
Publishing measure-ments	Dominant operators only	Canada: fixed telephony					
	All operators	India: all telephony France:mobile telephony Spain: mobile telephony	UK: fixed telephony	UK: mobile telephony	UK: all internet	Chile (formerly): all internet Spain: fixed telephony	

Organisations making measurements, auditing measurements and publishing measurements: comparative disadvantages

Activity	Monitored operators	Responsible organisation					
		Regulator	Group of operators with regulator	Group of operators without regulator	Other monitor	Operator	Customer
Making measure-ments	Dominant operators only	Does not use findings by operators. Is not realistic always.	Is not realistic for fixed telephony. Needs audits.	Is not realistic for fixed telephony. Needs audits.	Is not realistic for fixed telephony. May not test enough.	Does not get economies of scale. Needs audits.	Is not realistic for any telephony. Is not representative.
	All operators						
Auditing measure-ments	Dominant operators only			Needs further spot checks by regulator.	Is not feasible.	Needs further spot checks by regulator.	Is not feasible.
	All operators						
Publishing measure-ments	Dominant operators only			Does not get endorsement by regulator.	Does not get endorsement by regulator.	Does not provide easy comparisons.	Is not feasible.
	All operators						

Reviewing achievements: general observations

- Reviews may tend to add measurements, not to remove them:
  - In Brazil the number of measurements per operator was doubled.
  - In Canada dial tone delay is still measured, and some overlapping and redundant measurements have been kept explicitly to preserve continuity.
- Reviews may have extensive effects:
  - In Chile the scheme for internet access and transit service providers was suspended, as the legislation was to be updated to deal with new services.
  - In Ireland the scheme for fixed operators was suspended, as it was not useful enough to justify the cost and inconvenience to small operators.
  - In the UK the schemes for fixed and mobile operators were revised, as they were not useful enough.

Consulting stakeholders: general observations

- Consultations can give customers a voice in licences and regulations.
- Consultations can use the experience and knowledge of operators.
- Consultations can simplify monitoring for operators and the regulator:
  - In Jordan the number of measurements per operator was halved and the number of reporting periods was halved.

Techniques for encouraging and enforcing compliance: comparative disadvantages

Encouragement

- **Publishing all measurements and unattained targets:**
  - Can be laborious.
- **Publicising deficiencies to customers:**
  - Will not work well without firm comparisons with other operators or against targets.

India

- **Demanding extra measurements and detailed targets:**
  - Can lead to an emphasis on measurement procedures instead of problem solutions.
  - May not work well when long term actions are needed to improve quality.
- **Monitoring the implementation of remedial plans:**
  - May require work by external agencies skilled in network design and operation.

Australia

- **Requiring compensation to customers:**
  - May not be feasible when customers do not need accounts or bills are often wrong.
  - May not work well when quality aspects are not noticeable immediately by customers.

Brazil

- **Imposing fines:**
  - Can involve extensive legal processes.
  - Can take a long time.

Colombia

- **Changing prices:**
  - Will not work well without careful design.
- **Excluding access to government contracts:**
  - Can be difficult to make proportionate to failures by operators.
  - May not be feasible when several operators do not comply.

Enforcement

Relating quality to profitability

- **Rate of return regulation might be expected to increase quality, as staff will want to have the best possible system unconstrained by cost.**
- **Incentive regulation might be expected to decrease quality, as it puts pressure on costs.**
- **However, studies may even show the opposite:**
  - **In the US studies of retail services show some quality aspects improving with the shift from rate of return regulation to incentive regulation, but the improvement is not consistent between studies that have varying interpretations of the aspects.**
  - **In the US studies of wholesale services show some quality aspects deteriorating over time, but the deterioration is not correlated with the shift from rate of return to incentive regulation.**

Resolving quality problems directly

- Encouraging and enforcing compliance may not be the best way of addressing problems.
- Eradicating root causes by central action may be more effective:
  - Poor customer support due to skill deficiencies may be reduced by introducing national training programmes.
  - High call failure ratios due to interconnection shortages may be reduced by opening the fibre backbones of utilities and transport systems.
  - High fault report rates due to equipment limitations may be reduced by investing in network modernisation.

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Making measurements: widespread choices (with many differences of detail)

• **Time taken to do actions:**	
– The "service supply time" is the average time to supply services.	Colombia
– The "fault repair time" is the average time to repair faults.	Colombia
– The "call setup time" is the average time to setup calls.	Malaysia
– The "packet transfer time" is the average time to transfer packets.	Chile (formerly), Malaysia
• **Timeliness of actions:**	
– The "service supply timeliness" is the proportion of occasions when services are supplied on time.	Australia, Brazil, India, Ireland (formerly), Malaysia, UK
– The "fault repair timeliness" is the proportion of occasions when faults are repaired on time.	Australia, Brazil, India, Ireland (formerly), Malaysia, UK
– The "complaint resolution timeliness" is the proportion of occasions when complaints are resolved on time.	Brazil, India, Ireland (formerly), UK
• **Rate of occurrences of events per customer:**	
– The "fault report rate" is the number of fault reports per customer.	Brazil, Colombia, India, Malaysia, UK
– The "complaint rate" is the number of complaints per customer.	Brazil, Malaysia
• **Ratio of occurrences of events having some type to all occurrences:**	
– The "bill error ratio" is the proportion of bills that are erroneous.	Brazil, India, UK
– The "call setup success ratio" is the proportion of call setups that are successful.	Brazil, India, UK
– The "call drop ratio" is the proportion of calls that are dropped.	Brazil, India, UK
– The "packet loss ratio" is the proportion of packets that are lost.	Chile (formerly), Malaysia

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Making measurements: general observations

- **Many measurements are essentially independent of the service:**
  - **Supply: service supply time or timeliness.**
  - **Faults: fault repair time or timeliness, fault report rate.**
  - **Complaints: complaint resolution time or timeliness, complaint rate.**
  - **Billing: bill error ratio.**
- **Other measurements are apparently dependent on the service:**
  - **Reliability: call setup success ratio, internet session login success ratio, SMS message loss ratio, packet loss ratio.**
  - **Speed: call setup time, internet session login time, SMS message transfer time, packet transfer time.**
  - **Continuity: call drop ratio, internet session drop ratio.**
  - **Fidelity: conversational voice call quality, SMS message accuracy.**
- **Some measurements are alternatives to others.**
- **Several measurements are definable but unimportant.**

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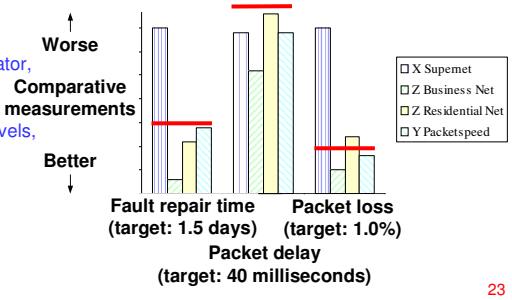
Publishing measurements: general observations

- **Measurements may be needed for separate geographic areas:**
  - **In Brazil about 2300 measurement results (1200 for fixed operators and 1100 for mobile operators) are published for every month.**
  - **In India about 2600 measurement results (800 for fixed operators and 1800 for mobile operators) are published for every 3 months.**
- **Measurements may be limited for customers:**
  - **In Australia about 150 measurement results (3 per fixed operator in different geographic areas) are published for every 3 months.**
  - **In Colombia about 300 measurement results (9 per fixed operator) are published for every 3 months.**
  - **In the UK about 100 measurement results (5 per fixed operator) are published for every 3 months.**

Publishing measurements: alternative presentations

Service name	Fault repair time (target: 1.5 days)	Packet delay (target: 40 milliseconds)	Packet loss (target: 1.0%)	Explanatory remark
X Supernet	3.5 days	34 milliseconds	3.5%	The quality was affected by slow fault repair by the backhaul operator.
Z Business Net	0.3 days	26 milliseconds	0.5%	The measurements were made when the service had very few customers.
Z Residential Net	1.1 days	38 milliseconds	1.2%	The measurements were made for this area jointly with others, not for this area separately.
Y Packetspeed	1.4 days	34 milliseconds	0.8%	

The measurements in the table are:
- presented for different operators in the same table,
- separate for different services from the same operator,
- published without extra irrelevant numbers,
- rounded to at most two figures,
- accompanied by explanations of unusual quality levels,
- expressed consistently (in this case with higher numbers always meaning worse quality).



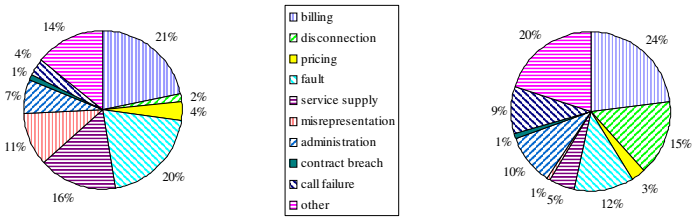
Guidelines for making measurements, publishing measurements and setting targets

- The measurements made should be:
  - Important to customers ►
  - Practical for operators ►
  - Comparable between operators ►
- The measurements published should be:
  - Accessible to customers ►
  - Helpful to customers ►
  - Fair to operators ►
- The targets set should be:
  - Useful to customers ►
  - Realistic for operators ►

Making measurements: guidelines: (1) importance to customers

- The measurements should be have an intended use.
- The measurements should be needed by those customers who collectively would be most seriously affected by unsatisfactory quality.
- The measurements should be made over short enough reporting periods and for small enough geographic areas to point to problems.
- The measurements should be reviewed as the market develops.
- The measurements should be chosen if possible according to customer opinion surveys and customer complaints analyses.
- The measurements should be end-to-end, not network-by-network, if possible.

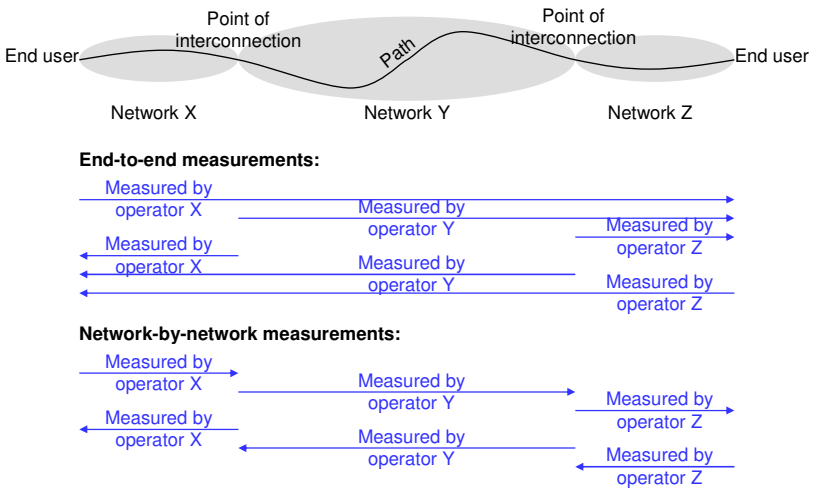
Making measurements: complaints to regulators in two countries in Africa



The proportions of complaints allocated to the classes "billing", "pricing", "administration" and "contract breach" were rather similar in the two countries.

The proportions of complaints allocated to the classes "disconnection", "service supply" and "misrepresentation" were very different in the two countries.

Making measurements: measurements across three networks



Making measurements: guidelines: (2) practicality for operators

- The measurements should require no more tests and calculations than characterise differences in quality that are perceptible to customers.
- The measurements should be the same as or similar to ones that operators make should make for their own purposes, if possible.
- The measurements should deal with matters that operators can control.
- The measurements should be aligned with those already used by the operators for customer support and network operation, if possible.

Making measurements: guidelines: (3) comparability between operators

- The measurement descriptions should expose any significant dependencies on choices by individual operators.
- The measurement methods should be precise enough that differences in interpretation and implementation should not lead to significant non-random differences in measurements:
  - They should either be objective (based on event times and counts) or be subjective (based on customer opinions) for all operators.
  - They should either be passive (obtained from real traffic) or be active (obtained from test traffic) for all operators.
  - They should make the same assumptions about significant boundary conditions (such as specifications of times and exclusions from counts) for all operators.

Making measurements: fault reports possibly excluded from counts

Reported by that user already
Reported by a different user already
On more than one connection using the same route
On more than one connection not using the same route
In customer premises equipment maintained by the operator
In customer premises equipment not maintained by the operator
In additional application software supplied by the operator
In additional application software not supplied by the operator
Due to normal operation of the service
Cured by the user before testing
Not detected during testing
Not present after testing
Due to maintenance at times notified to customers in advance
Due to maintenance at times not notified to customers in advance
Due to problems of another operator notified to customers in advance
Due to problems of another operator not notified to customers in advance
Due to disasters caused by human activity
Due to disasters not caused by human activity

Publishing measurements: guidelines: (1) accessibility to customers

- **The measurements should be published in a form directed either to customers or to others (such as journalists) active for customers.**
- **The measurements should be published using a suitable medium:**
  - **In some countries radio broadcasts or freephone calls would reach many more people than newspapers or websites.**
  - **In other countries readers would expect written words and prefer tables of numbers to graphs or bar charts.**
- **The measurements should have their locations or times of publication widely publicised and easily found.**
- **The measurements should be published at the same locations or times for all operators that are intended to be compared.**
- **The measurements should be published without extra, irrelevant, numbers.**

Publishing measurements: guidelines: (2) helpfulness to customers

- The measurements should deal with the aspects of services that customers are most concerned about.
- The measurements should relate to the aspects of services that customers can experience directly.
- The measurements should be described in terms that are comprehensible to customers.
- The measurements should be expressed so as to characterise differences in quality that are perceptible to customers but to suppress differences in measurements that are random:
  - In some countries the numbers are rounded to at most 2 significant figures.
  - In other countries the numbers are replaced by five point scales.
- The measurements should be presented consistently with each other.

Publishing measurements: guidelines: (3) fairness to operators

- The measurements for an operator that offers services with deliberately different quality levels and prices (for different market segments or geographic areas) should be published service-by-service.
- The measurements for an operator that uses the facilities of another operator in a way affecting quality might be published with remarks to explain deficiencies.
- The measurements for an operator that is too small to provide precise enough results might be published with remarks to explain the true state of affairs.

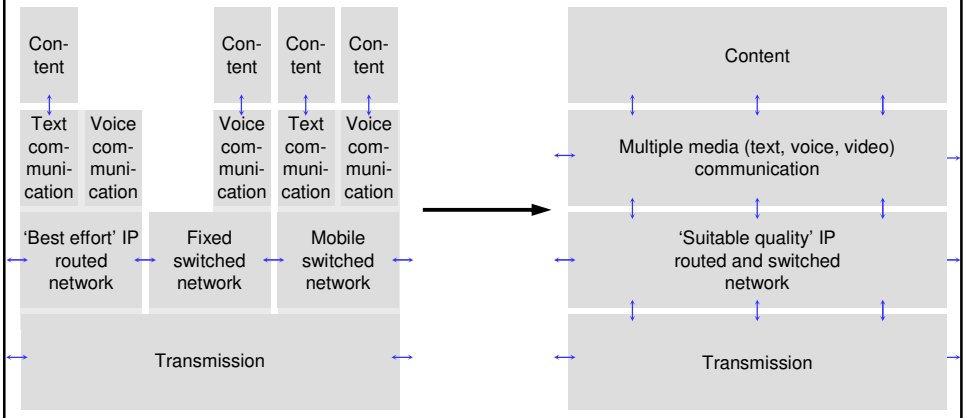
Setting targets: guidelines: (1) usefulness to customers

- The targets should have clear purposes:
  - In some countries targets are intended for maintaining quality and represent required minimum quality levels.
  - In other countries targets are intended for improving quality and represent desired or planned quality levels.
- The targets might be applied to dominant operators more than to other operators and to wholesale services more than to retail services:
  - End users are concerned with comparative quality levels, not absolute quality levels, when choosing between operators (though they may welcome constraints on the quality level of a dominant operator).
  - Operators are concerned with the quality levels for the facilities of dominant operators that they use for interconnection or resale.
  - Policy makers are concerned with end-to-end quality levels that are determined mainly by the access and core networks of dominant operators.

Setting targets: guidelines: (2) realism for operators

- The targets should relate to the quality levels that customers want in particular market segments and geographic areas.
- The targets should be developed after observing what the operators can achieve for a period.
- The targets should be developed without relying just on measurements (from that or other countries or in international standards) that are not comparable with the measurements chosen or that are not produced for the country.
- The targets should not limit the available choices of quality level and price, if possible.

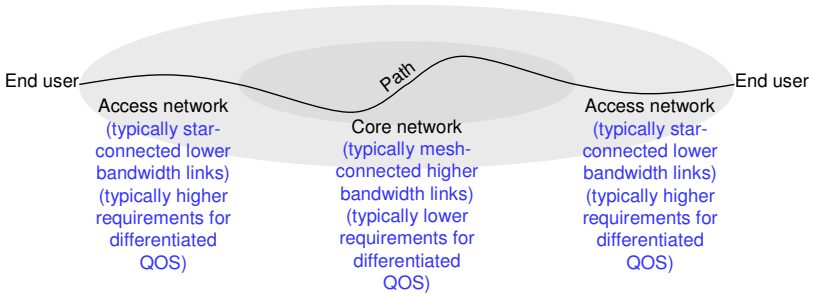
Moving from current networks to next generation networks



Quality of service monitoring: implications of next generation networks

- **Extra wholesale services between layers as well as between networks:**
  - **QOS needs to be assessed between layers as well as between networks (where it might sometimes involve monitoring differentiated quality levels).**
- **Multiple real time services, with different delay and loss requirements:**
  - **QOS needs to be understood and estimated end-to-end for different real time services (including those for people with disabilities).**
- **New 'walled gardens' and charges for 'suitable quality' IP:**
  - **QOS should be maintained for 'best effort' IP, to avoid forcing customers to higher quality levels (and higher prices) than necessary.**
- **Further bundles of services crossing several layers:**
  - **QOS might be published for the individual services to help customers comparing disparate bundles from different operators.**
- **Many different terminals, with different performance characteristics:**
  - **QOS should either identify or exclude the terminals.**
- **More intelligent terminals:**
  - **QOS might be monitored by terminals on behalf of customers.**

Access and core networks



Conclusions

- **Using operator skills and customer opinions helps to make monitoring effective.**
- **Defining measurements for all operators is most likely to be useful if the measurements are published.**
- **Setting targets is most likely to be appropriate for wholesale services (and often retail services) of dominant operators.**

- **The measurements made should be:**
  - **Important to customers***
  - **Practical for operators***
  - **Comparable between operators***
- **The measurements published should be:**
  - **Accessible to customers***
  - **Helpful to customers***
  - **Fair to operators***
- **The targets set should be:**
  - **Useful to customers***
  - **Realistic for operators***

* See background paper and charts for fuller details.