LESOTHO COMMUNICATIONS AUTHORITY

ITU-T Recommendation E.802 Amendment 1: New Annex A – Guidelines On Selection Of Representative Samples

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FAIRNESS TO ALL AND ALLEGIANCE TO NONE

SAMPLE SIZE

- **Factors that influence the size of a sample include:**
  - Purpose of tests – in this case QoS verification
  - Resources available, e.g. probes, money for tests
  - Traffic per location
- **Statistical factors include the following 3 criteria:**
  - The level of precision
  - The level of confidence or risk
  - The degree of variability in the attribute being measured

SAMPLE SIZE CRITERION 1

- **Level of precision/Sampling error/Margin of error/Confidence interval**
  - Often expressed as percentage
  - The range in which the true value of the QoS parameter (measured from real traffic) is estimated to be.
  - Q: "If out of 100 calls, 99 have a good quality and 1 has bad quality – is there a standard defining a ratio saying what is overall good or bad quality?"
  - A: If that 100 is real traffic, then we can simply conclude that there is 99% good quality; but if that 100 is a sampled traffic, then the defining ratio will depend on the **sampling error** at which that quality was measured.
  - Example: if 9% of calls in a Sample drop with a **precision level of ±5%,** then we can conclude that for real traffic, call drop ratio is between 4% and 14% (i.e. 9-5 & 9+5)

SAMPLE SIZE CRITERION 2

- **Confidence level/risk level**
  - Tells us how likely it is that the true QoS parameter falls within the range of precision specified.
  - For **95% confidence level** , 95 out of 100 samples will have the true QoS parameter value within the specified range of precision.
  - There is always a risk that the sample does not represent the true QoS parameter, and that risk is reduced for **99% confidence level** & increased for **90% confidence level.**
  - ITU-T Recommendation E.802 Annex A recommends a confidence level of 95%

SAMPLE SIZE CRITERION 3

- **Degree of variability**
  - Depends upon the traffic and the distribution of the quality of service under observation in that traffic
  - If we expect with certainty that there is a proportion of 20% dropped calls in the traffic, then an 80/20 split of the traffic would be appropriate, hence the sample is less variable.
  - A 50/50 split of a specific quality attribute indicates maximum variability of that attribute. If we do not know what level of variability to expect from the traffic under consideration then we assume that it is 50%

SAMPLE SIZE CALCULATION

- To be able to specify different levels of precision, or different degrees of variability, depending on the purpose of measurement, then

$$n_0 = \frac{Z^2 pq}{e^2}$$

Where

- n_0 is the sample size
- Z depends on the degree of confidence you want to have in calculated Qos parameters
- e is the desired level of precision.
- p is the estimated proportion of the quality attribute present in the traffic
- q is $1 - p$

Note that pq = degree of variability

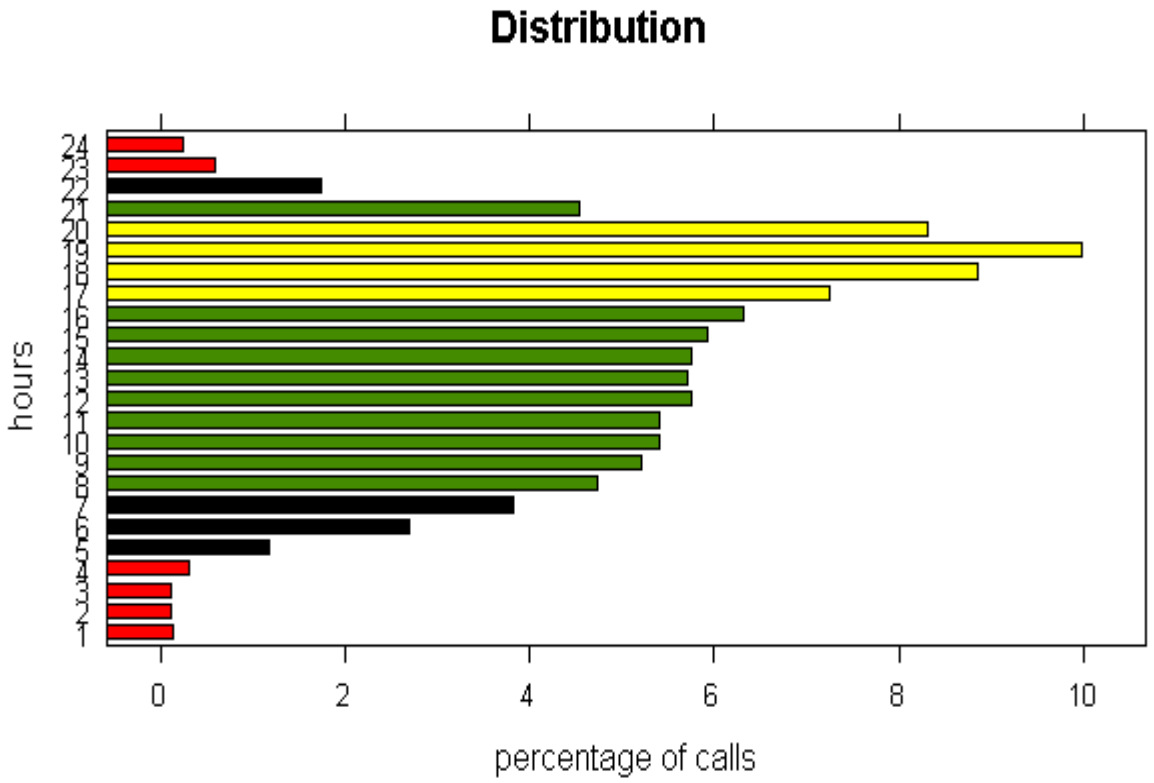
EXAMPLE OF CALCULATED SAMPLE SIZES

Sample size (n) for precision (e) where Confidence Level is 95% and P = 0.5			
±3%	**±5%**	**±7%**	**±10%**
1, 067	384	196	96

SAMPLING OR DISTRIBUTING THE SAMPLE SIZE

- To ensure that traffic variations are adequately taken into account during the measurement period:
  - Study the traffic variations of the network
  - A 12 month traffic of that network can give a proper indication of what variations exists in the traffic
- Once the traffic variations are known, it then becomes possible to determine the distribution of sample measurements
  - More tests will be required where there are peak traffic, and less test will be required where there are periods of low traffic

SNAP SHORT FROM THE SAMPLE CALCULATOR



SAMPLING DESIGN GENERATION BY SAMPLE CALCULATOR

From the above distribution, a sample calculated at 95% confidence level, ±5% precision level, and 0.5 degrees of variability

Group	Range of Hours	No of Hour	Sample	Sampling Interval
1	08:00 - 16:59 & 21:00 - 21:59	10	210	3
2	17:00 - 20:59	4	133	2
3	05:00 - 07:59 & 22:00 - 22:59	4	36	7
4	23:00 - 04:59	6	6	65
Total		24	385	

PRACTICAL SAMPLING DESIGN

- Instead of carrying all 385 measurements over one day, they can also be carried out over 7 days, where 55 measurements per day can be carried out.
- 385/7days = 55 samples. And (210/385)*55=30samples in G1

Group	Range of Hours	No of Hour	Sample	Proportion of traffic
1	08:00 - 16:59 & 21:00 - 21:59	10	30	0.548
2	17:00 - 20:59	4	19	0.345
3	05:00 - 07:59 & 22:00 - 22:59	4	5	0.094
4	23:00 - 04:59	6	1	0.016
Total		24	55	

DEMONSTRATION OF SAMPLE CALCULATOR

- **RStudio**

THANK YOU