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General Packet Radio Service (GPRS) is one of the major services currently standardized by the European Telecommunications Standards Institute (ETSI) for Global System for Mobile Communication (GSM) Phase 2+. GPRS can accommodate a tremendous number of packet-switched traffic such as e-mail, World Wide Web traffic, and telemetry. Nevertheless, the insistence of GPRS has been on the Quality of Service (QoS) at the network level, instead of from the end-user’s point of view. Since the ultimate juror of the quality of service is the end user, it is necessary to carry out subjective measurement of data quality, and the goal of our project is to develop an Data Quality Index (DQI) algorithm that is similar to Speech Quality Index (SQI) and Mean Opinion Score (MOS) which can use the radio data to measure the performance of the different data services.

We have implemented the DQI algorithm into a graphic user interface program that will assign a DQI index to the network for a particular application, with network parameters and type of network application as the input. The program will provide a graphical user interface that accepts the input of the data stated above and display the index comparing with the data given by SUNDAY Communications Limited. The objective of this project is to provide a clear idea of the quality of service of GPRS system to network operator, with a simple index assigned to the network. Network operator can modify or improve the network easily with the help of the DQI, in order to provide better services, given that the DQI could reflects the network quality accurately. Figure 1 shows the system block diagram of our data quality index algorithm:

![Figure 1 – System Block Diagram](image-url)
We proposed that
\[ DQI = \alpha (\text{blocking rate}) + \beta (\text{mean LLC throughput}) + \gamma (\text{queuing delay}) \]
where \( \alpha, \beta \) and \( \gamma \) are coefficient to make the DQI in between a perceptible scalable range.

As shown in the above equation, the objective measurement of DQI is contributed by average blocking probability, average throughput, and average queuing delay, where the coefficients \( \alpha, \beta \) and \( \gamma \) are the insistence elements of the subjective judgments.

\[ \text{LLC throughput} = \frac{\text{Information data per LLC frame}}{\text{LLC frame service time}} \]

\[ \text{LLC frame service time} = (1 - P_m)(T_{\text{LLC RLC/MAC}})(1 + \sum_{k=2}^{L} P_{m}^{k-1}) \]
where \( P_M \) is the probability of RLC/MAC failure and \( T_{\text{LLC RLC/MAC}} \) is the service time of an LLC frame at the RLC/MAC layer.

Queuing delay is a function of RLC/MAC failure, which is a function of
\[ P_M = N \cdot P_{B}^{M} \cdot P_{r}(C/I \leq R) \]
where \( P_B \) denotes the block error rate.

We suggested the final result of DQI is similar to SQI, with an output in the range 1 to 5, where values close to 1 indicate bad data quality, and values close to 5 indicate excellent data quality. Table 1 shows the grading of DQI.

<table>
<thead>
<tr>
<th>Data Quality Index</th>
<th>Quality of Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fail</td>
</tr>
<tr>
<td>2</td>
<td>Below Average</td>
</tr>
<tr>
<td>3</td>
<td>Fair</td>
</tr>
<tr>
<td>4</td>
<td>Good</td>
</tr>
<tr>
<td>5</td>
<td>Excellent</td>
</tr>
</tbody>
</table>

*Table 1 – DQI grading scheme*
The outlook of the GUI Software to analysis the data quality

The output graph of the data quality index