DEVELOPMENT OF AN IMPROVED QUALITY OF SERVICE MODEL FOR ELECTRONIC COMMERCE

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ABSTRACT

This research designed an intelligent based bandwidth management model which was simulated and evaluated based on performance metrics, and a prototype of the model was implemented.

A survey of the existing QoS provisioning models and their *modus operandi* were carried out. Eighty questionnaire were administered in Southwestern Nigeria to identify the requirements and the needs of e-commerce clients that are peculiar to developing countries. Findings from the data gathering stage prompted the proposition of an intelligent QoS provisioning model based on Unified Modelling Language (UML). The sub-modules of the model consisted of a Fuzzy Semantic Information Retrieval (FSIR) engine, which returns a ranked list of objects that have been estimated to satisfy the user's request; a Fuzzy Inference based Bandwidth Manager (FIBM) which determines the proportion of the service rate that is assigned to user's request, and a Fuzzy Inference based Data Compressor (FIDC) which determines the image variant to transmit depending on the traffic and clients' systems conditions. The Fuzzy Logic toolbox from Matlab was used to model the sub-modules. A prototype of the model was implemented as a web based n-tier application comprising of the client tier, the web tier and the enterprise tier using Java 2 Enterprise Edition (J2EE) language. In order to investigate the performance of the proposed model, a simulation program was developed using MATLAB modelling language. In the simulation, clients' systems characteristics, their purchase histories and page sizes after a search operation is performed were randomly generated from statistical distributions. The daily traffic pattern of the Obafemi Awolowo University Network was used to model the traffic in the simulation. The ability of the proposed model was benchmarked with the current Internet Best-Effort model using the QoS performance metrics such as response time, throughput, and latency.

The simulation result revealed a better performance of the proposed model over the Best

Effort model with about 52% reduction in system response time, 66% reduction in system latency, and 115% increment in system throughput at a bandwidth of 1Mb for a network of 600 clients. The MATLAB normal probability plot when used to analyse the results at 95% confidence intervals, indicated that 75th percentile of the observations under the Proposed had response time of less than 8.5 seconds, latency of 0.85 second, and a throughput of 56%. The effect of using sub-standard systems to query a web server, a feature that is absent in existing QoS provisioning schemes, was also investigated. Clients using sub standard systems under the proposed and Best Effort model had mean response times of 12.43s and 22.04s with standard deviations of 0.2s and 3.5s respectively, during the off peak and peak load conditions. Thus the proposed model produced consistent system response time for clients. The result obtained from the prototype implementation was in good agreement with the simulations.

It was concluded that the robust and intelligent QoS provisioning model developed and implemented in J2EE provided effective management of quality of service of web applications, particularly where computing and network resources are limited.