

**A Non-Monetary Mechanism for Optimal Rate Control Through Efficient Cost Allocation**

**Abstract:**

This paper proposes a practical non-monetary mechanism that induces the efficient solution to the optimal rate control problem, where each client optimizes its request arrival rate to maximize its own net utility individually, and at the Nash Equilibrium the total net utility of the system is also maximized. Existing mechanisms typically rely on monetary exchange which requires additional infrastructure that is not always available. Instead, the proposed mechanism is based on efficient cost allocation, where the cost is in terms of nonmonetary metric, such as average delay or request loss rate. Specifically, we present an efficient cost allocation rule for the server to determine the target cost of each client.We then propose an intelligent policy for the server to control the costs of the clients to achieve the efficient allocation. Furthermore, we design a distributed rate control protocol with provable convergence to the Nash Equilibrium of the system. The effectiveness of our mechanism is extensively evaluated via simulations of both delay allocation and loss rate allocation against baseline mechanisms with classic control policies.

**Existing System:**

Which entails maximizing the total net utility in the system, is typically convex, and it is thus easy to solve when one has complete information of all the individual utility functions. In practice, however, the utility functions are often private information of clients, and a strategic client that aims to maximize its own net utility may not reveal its true utility function. Further, request rates are directly controlled by clients, instead of the server. Most existing work employs some auction or pricing scheme that ensures strategic clients reveal their true functions and follow the assigned rates from the server. However, these schemes involve additional monetary exchange between clients and the server, which requires additional infrastructure that is not always available.

**Proposed System:**

We propose a novel non-monetary mechanism for optimal rate control to address this issue. Note that each client suffers from some disutility based on its experienced delay or request loss rate, and the server can indirectly adjust such disutility experienced by each client through its employed control policy. Therefore, the server can potentially steer request rates of strategic clients toward the optimal point through its control policy. Effectively, the server uses “delay” or “loss rate” as a kind of “currency.” In economic terms, there are negative externalities from a client increasing its request rate, since this increases the overall cost, in the form of delay or loss rate, of all clients. This is an analogy to a public goods problem, in which one client’s consumption choice affects the utility and payoffs of the other clients. As such, the server’s objective is to design an allocation scheme such that each client internalizes these negative externalities, thereby leading to efficient consumption of resources.