OPTIMAL ADMISSION CONTROL POLICY OF A FLOW-AWARE NETWORKING ARCHITECTURE

César Cárdenas-Pérez (cardenas@enst.fr), PhD Student

1ENST Paris, Network and Computer Science Department
46 Rue Barrault, 75013, Paris

Quality of service (QoS) provisioning in Internet networks is a very important issue in the telecommunications industry [1]. For example, users perceive QoS as network delays and information losses. Moreover, the evolution of the Internet traffic by means of new applications and technologies gives QoS complex. When a commercial solution is installed, optimal operational and decision problems appear. QoS is therefore very complicated and its analysis involves such mathematical disciplines as probability, stochastic calculus, queueing theory and optimization among others.

Up to now, there is no solution by using only Internet technology. The Internet Engineering Task Force (IETF) has standardized some router systems (architectures) for QoS: Intserv, Diffserv and MPLS [1]. These architectures are not mathematical founded [2]. Other options try to solve this QoS problem, in particular Flow-Aware Networking (FAN) architectures [3], [4], that start to be commercialized [4].

FAN architectures make decisions at flow level but still working at packet level. A flow is defined as a series of packets with same properties (e.g. source and destination). Hence, a TCP connection (e.g. open a web page), a UDP connection (e.g. voice over Internet) or a Peer-to-Peer transfer are considered as flows. Flows are generated by user sessions. As user sessions are generated independently by a big quantity of users, we assume that the arrival process of flows follow a Poisson process [5]. Flow level imitates well the human behavior in Internet networks [6]. So, FAN architectures use more tractable models [7]. FAN architectures are scalable [8].

---

1Current solutions use Asynchronous Transfer Mode (ATM) technology together with Internet technology giving this approach expensive and complex to manage.
2Main device in Internet networks. It forwards packets to next router up to destination.
3Developed and patented by France Telecom Research and Development
5Packets are the atomic unit of Internet traffic.
6By the Poisson-In-Poisson-Out property flows arrive following a stationary Poisson Process.
Traffic measurements show that major Internet applications are based on TCP and UDP protocols (over 90% in terms of bytes and over 80% in terms of flows for TCP). Thus, Internet traffic is composed only by these applications. For traffic control purposes, this classification is simple and robust. As TCP adapts its rate based on network congestion is called elastic. UDP is called streaming.

FAN architectures propose an admission control protocol based on performance measures of their queueing system (e.g. closed-loop). Flow-based admission control has been studied in [9], optimal admission control has been studied since the 60’s [10]. To our knowledge, optimal admission control at flow level as proposed by FAN architectures have not been studied previously. Related work is [11] and [12]. This work has the objective to find the mathematical structure of the optimal admission control policies for minimizing the delay and losses of streaming flows subject to a bounded throughput for elastic flows. The optimality criterion considered is the average cost. The optimal admission control is a very important operational issue. It determines optimal decisions at every decision epoch (e.g. each flow arrival). It is a critical issue for obtaining efficient traffic management in current Internet networks.

Bibliography


http://www.caida.org