Perron-Frobenius Theory Approach to AIMD

- Perspective via positive linear systems theory [12] [13]
- Let $w_s(k)$ denote the congestion window size of source s immediately before the kth network congestion event is detected by all the sources as shown in Figure 2.
- Let α_s and $0 < \beta_s < 1$ be the additive and multiplicative parameters of source s using the AIMD algorithm (that are conventionally set as 1 and 0.5) respectively
- Let $q_{\max}$ and P be, respectively, the maximum queue length of the congested bottleneck link and the maximum instantaneous number of sent unacknowledged packets that are in transit (e.g., $P = q_{\max} + BT$ where B is the bottleneck link service rate in packets per second and T is the round-trip time)

[12] Abraham Berman, Robert Shorten, and Douglas Leith. Positive matrices associated with synchronised communication networks. Linear Algebra and its Applications, 393:47–54, 2004.

[13] Martin Corless, Christopher King, Robert Shorten, and Fabian Wirth. AIMD Dynamics and Distributed Resource Allocation. Society for Industrial and Applied Mathematics, 2016.