Corrections

Correction to "A New Approach to Service Provisioning in ATM Networks"

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We make three corrections to the above noted paper.[1]

First, A unit of type s service should simply be a type s connection, as opposed to 'a type s connection per unit time' defined at the beginning of Section II (Equation (6) is incorrect under the old definition). It is sold at w_s per unit time. Three changes are needed as a result: i) $1/T_s$ should be edited out from every place it appears; ii) equation (18) should be multiplied by T_s, so is the rent in 3) of User Algorithm; iii) α_l and β_l are prices per unit of bandwidth and buffer, respectively, *per unit time*. Note that the amounts of service are approximated by continuous variables in the paper.

Second, the welfare function $W'(w, x, \mu)$ should be defined as

$$W'(w, x, \mu) := \sum \int_{w_s}^{\infty} \min(x, D_s(v))dv + \sum x_s w_s$$

Fix μ. With the definition in the paper, an equilibrium (w, x) does not generally maximize W' subject to conditions (6)–(7). With the new definition, the unique equilibrium maximizes W' subject to conditions (6)–(7), and the maximum welfare is indeed given by (13) in the paper, as proved next.

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[1] S. H. Low and P. P. Varaiya, *IEEE/ACM Trans. Networking*, vol. 1, pp. 547–553, Oct. 1993.

Let

$$p_s(x_s, w_s) = \begin{cases} D_s^{-1}(x_s) & \text{if } x_s \le D_s(w_s) \\ w_s & \text{if } x_s > D_s(w_s) \end{cases}$$

Then the welfare function becomes

$$W'(w, x, \mu) := \sum \{x_s p_s(x_s, w_s) + \nu_s exp[-p_s(x_s, w_s)]\}$$

On the set $\{(x, w)|x_s < D_s(w_s)\}$, $p_s(x_s, w_s) = D_s^{-1}(x_s)$. Hence $\frac{\partial W'}{\partial x_s} = D_s^{-1}(x_s) > 0$ for $x_s < \nu_s$ and $\frac{\partial W'}{\partial w_s} = 0$, i.e., any maximizer (x, w) must satisfy $x_s = D_s(w_s)$ provided condition (7) is satisfied. We can restrict our search for a maximizer to the set $\{(x, w)|x_s = D_s(w_s)\}$ and consider the equivalent problem:

$$\begin{array}{ll} \max_{x \ge 0} & V'(x) := \sum x_s(D_s^{-1}(x_s) + 1) \\ \text{subject to} & \text{equation (7) in paper} \end{array}$$

By the Kuhn-Tucker theorem, x^* is a maximizer only if $\exists \alpha \ge 0, \beta \ge 0$ such that $\frac{\partial V'(x^*)}{\partial x_s} - \sum_l (\alpha_l \mu_{ls} + \beta_l b_s(\mu_{ls})) \le 0$ with equality if $x_s^* > 0$. Since $x_s^* = D_s(w_s^*) > 0$ and $\frac{\partial V'(x^*)}{\partial x_s} = D_s^{-1}(x_s^*)$, a necessary condition for (x^*, w^*) to be a maximizer is

$$w_s^* = D_s^{-1}(x_s^*) = \sum_l (\alpha_l \mu_{ls} + \beta_l b_s(\mu_{ls}))$$

Since V' is strictly concave ($\frac{\partial^2 V'(x)}{\partial x^2} = -diag(\frac{1}{x_s}) < 0$), the condition is also sufficient. The assertions now follow from Proposition 1.

Finally, the second "−" sign in the definition of $G(\mu, \alpha, \beta)$ and in 3) of Network Algorithm should be a "+" sign. In Proposition 1, the complementary slackness condition on $(\alpha(\mu), \beta(\mu))$ is inadvertently left out.

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