

Variations on the Stack Protocol for Collision Resolution

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Abstract

The problem considered is that of protocol design and analysis for regulating access to a channel shared by many users. A collision resolution protocol called the stack algorithm was discovered by N. Vvendenskaya and B. Tsybakov near 1980 and achieves this goal. The algorithm bears strong relations to the tree protocol proposed independently by Capetanakis. Like the Ethernet protocol, the stack algorithm permits to resolve probabilistically collisions on a shared communication channel. Unlike the Ethernet protocol, it appears to have good stability properties.

Bibliographical data

The original stack algorithm is described by Tsybakov, Mikhailov and Vvendenskaya in [4, 5]. The idea is to separate recursively colliders into groups based on random coin flippings. (In contrast, Ethernet uses increasing delays determined probabilistically in the case of a collision.)

Early results on such random access methods are presented in the book edited by Longo [3]. It has been established that the protocol (in the slotted time model and under Poisson arrivals) is stable for arrival rates till $\lambda = 0.34$ (blocked arrivals), $\lambda = 0.36$ (continuous arrivals), see [1, 2] for detailed analyses based on functional equations and Mellin transforms. (In contrast, Ethernet is known to be unstable for any $\lambda > 0$, a result due to Aldous.) Various improvements due to Gallager, Massey, Greenberg, and others permit to come close to the limit of $\lambda = 0.5$.

The special issue of the *IEEE Transactions on Information Theory on Random Access Communication* edited by Jim Massey (*IEEE-IT* **31**(2), March 1985) contains a complete survey that still serves as a reference in the field.

Bibliography

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