Modeling Variable Throughput Channels with Stochastic ODEs

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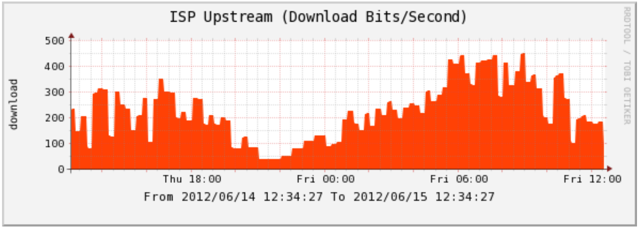
Outline

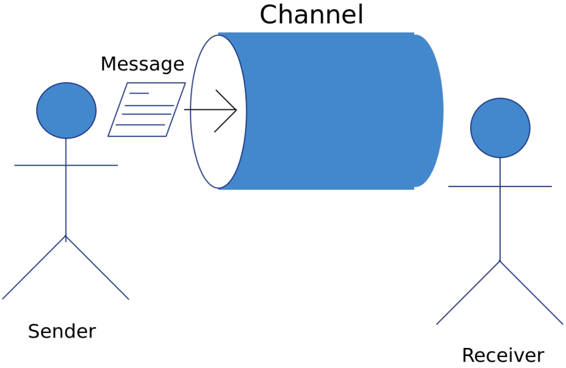
Introduction



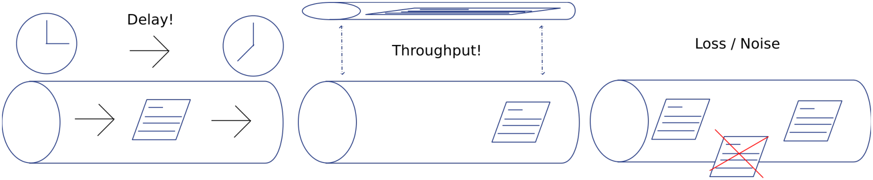
Stochastic differential equations are often used to model the nondeterministic behavior of network channels in computer science.

Networking Basics

A **Channel** is the medium through which a message propagates from sender to receiver.



Channel Characteristics



Euler-Marauyama Method

We approximate the solution by assigning y-values $w_0 < w_1 < w_2 < \cdots < w_n$ at discretized t, given the SDE IVP

$$dy(t) = f(y,t)dt + g(t,y)dB_t \quad (1)$$

$$y(a) = y_a \quad (2)$$

1: **procedure** EULER-MARAUYAMA METHOD
2: $w_0 \leftarrow y_0$
3: **for** $i = 0, 1, 2, \cdots$ **do**
4: $\Delta t_i \leftarrow t_{i+1} - t_i$
5: $\Delta B_i \leftarrow B_{i+1} - B_i$
6: $w_{i+1} \leftarrow w_i + f(t_i, w_i)(\Delta t_i) + g(t_i, w_i)(\Delta B_i)$

algorithm 1: euler-marauyama method, numerical method for SDE

Demonstration