This work concerns the fractional Poisson process and its properties. The aim of this work is to derive some of its properties in detail. The first chapter contains the basics of the theory of random processes, fractional calculus, especially in connection with fractional differential equations, the Laplace transform and some properties of the classical Poisson process. The second chapter contains the definition of the fractional Poisson process and from it, using the theory from Chapter 1, we derive the fractional Poisson distribution, mean value and variance, as well as the proof of non-stationarity of increments and other properties. Finally, simulations of its trajectories are given of various values of parameters.