independent stochastic processes

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Two stochastic processes $\{X(t) \mid t \in T\}$ and $\{Y(t) \mid t \in T\}$ are said to be if for *any* positive integer $n < \infty$, and *any* sequence $t_1, \ldots, t_n \in T$, the random vectors $\boldsymbol{X} := (X(t_1), \ldots, X(t_n))$ and $\boldsymbol{Y} := (Y(t_1), \ldots, Y(t_n))$ are independent. This means, for any two n-dimensional Borel sets $A, B \subseteq \mathbb{R}^n$, we have

$$P\Big[\boldsymbol{X}^{-1}(A) \cap \boldsymbol{Y}^{-1}(B)\Big] = P\Big[\boldsymbol{X}^{-1}(A)\Big] P\Big[\boldsymbol{Y}^{-1}(B)\Big].$$