Informal Definition of a Petri Net

A Petri net is a directed graph together with a state, soon to be described. Each node of the graph is either a place (represented by a circle) or a transition (represented by a bar). Each arrow connects either a place to a transition or a transition to a place. The state of a Petri net is a mapping of the set of Petri net places into the set of non-negative integers. If the integer $k$ is associated with a place $P$, we say that there are $k$ tokens on place $P$.

A transition can fire if and only if every place leading to the transition (i.e., each place having an arrow from it to the transition) has one or more tokens. If a transition fires, exactly one token is removed from each place leading to it, and one token is added to each place the transition leads to (i.e., each place to which there is an arrow from the transition).

If no transitions can fire, then we say that the Petri net is dead. If the Petri net is not dead, then it is live and, of those transitions that can fire, exactly one fires. Thus, the Petri net moves nondeterministically through a sequence of states, as one transition after another fires.

Figures 1, 2, and 3 illustrate these concepts. They represent a Petri net in three different states. The places are labeled $A$, $B$, and $C$, and transitions are labeled $r$, $s$, and $t$. The state of the Petri net in Figure 1 has a single token on place $A$. The only transition that can fire is $r$. When $r$ fires, the state of the Petri net changes to that of Figure 2. The token has been removed from place $A$ and tokens have been placed on places $B$ and $C$.

At this point, either transition $s$ or transition $t$ can fire. If transition $s$ fires, then the state of the Petri net is shown in Figure 3. The Petri net in Figure 3 is dead because no transition can fire. On the other hand, if transition $t$ in Figure 2 fires, then the Petri net returns to the state shown in Figure 1.