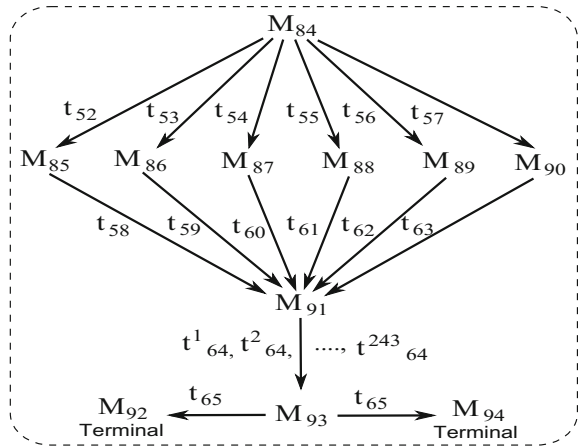


Fig. A.1 Reachability tree for Petri net model PN_u

$[t_{44}] M_{80} [t_{45}] M_{81} [t_{46}] \widehat{M}_{82}$, and $M_{62} [t_{24}, t_{25}, t_{26}, t_{27}, t_{28}] M_{63} [t_{30}] M_{65} [t_{39}, t_{40}] M_{67} [t_{41}] M_{71} [t_{42}] M_{75} [t_{43}] M_{78} [t_{44}] M_{80} [t_{45}] M_{81} [t_{46}] M_{83} [t_{51}] \widehat{M}_{64}$ to optimize anomaly verification agent transmission.

The cross-layer Petri net model PN_c , shown in Fig. A.2, executes the cross-layer anomaly detection and anomaly verification agent transmission optimization algorithm through the markings $M_{84} [t_{52}, t_{53}, t_{54}, t_{55}, t_{56}, t_{57}] M_{85}, \widehat{M}_{86}, M_{87}, M_{88}, M_{89}, M_{90} [t_{58}, t_{59}, t_{60}, t_{61}, t_{62}, t_{63}] M_{91} [t_{64}^1, t_{64}^2, \dots, t_{64}^{243}] M_{93} [t_{65}] \widehat{M}_{92}$ and $M_{84} [t_{52}, t_{53}, t_{54}, t_{55}, t_{56}, t_{57}] M_{85}, M_{86}, M_{87}, M_{88}, M_{89}, M_{90} [t_{58}, t_{59}, t_{60}, t_{61}, t_{62}, t_{63}] M_{91} [t_{64}^1, t_{64}^2, \dots, t_{64}^{243}] M_{93} [t_{65}] \widehat{M}_{94}$, where \widehat{M}_{92} and \widehat{M}_{94} are terminal states which show states of the cluster leader node to aggregate sensed data and decrement the trust value of the cluster member node, respectively.

Fig. A.2 Reachability tree for Petri net model PN_c



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