Stability of the MATSim Learning process

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IVT Institut für Verkehrsplanung und Transportsysteme
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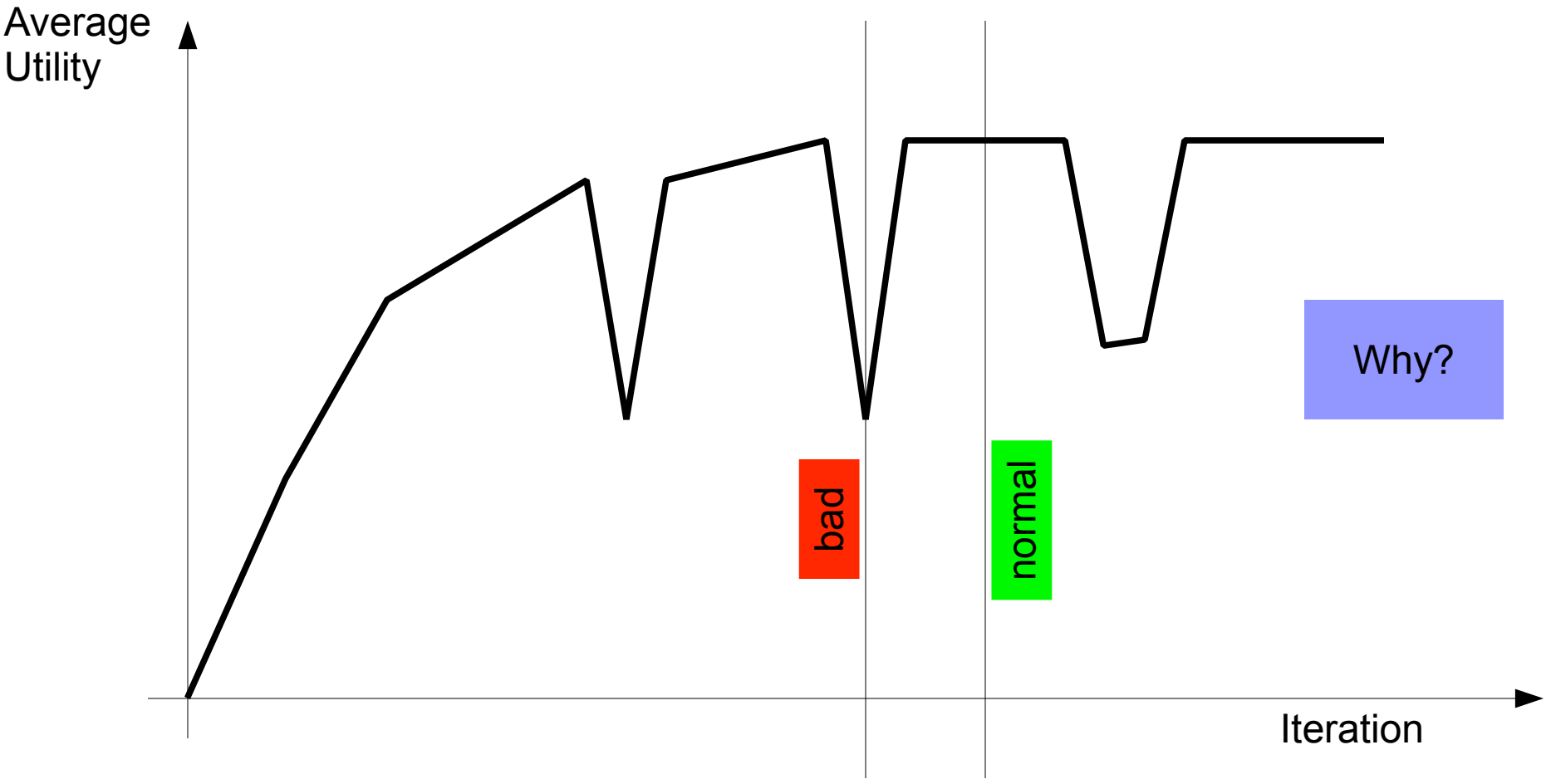
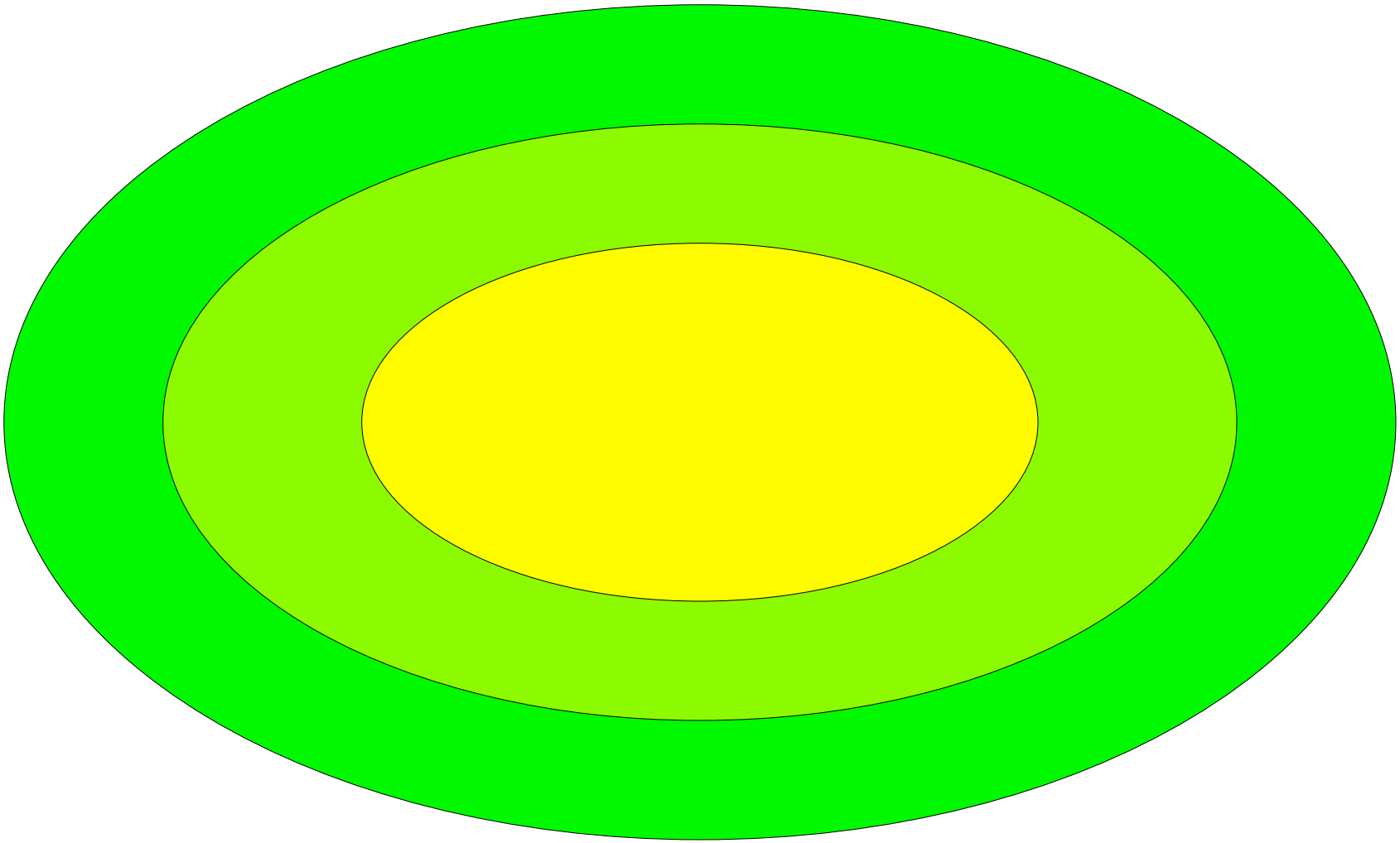
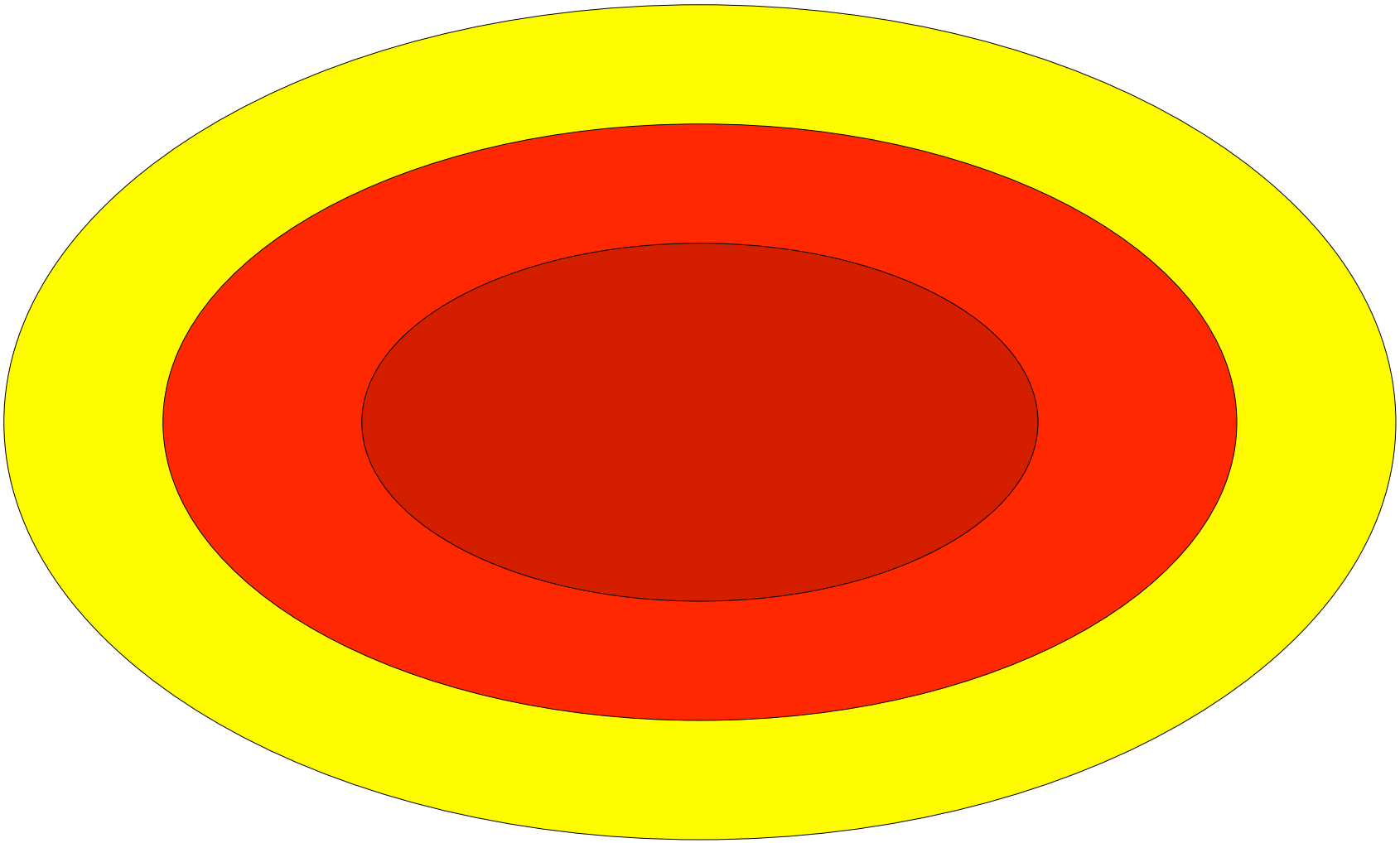
Utility Over Iterations



Network Performance in Normal Case



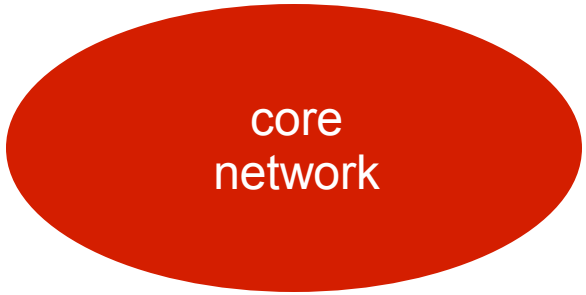
Network Performance in Bad Case



Open Questions

- What is really happening?
- Why does the system change from an OK state to a totally congested one
- Which part of the system is responsible (router, time allocation, microsimulation)?
- How can the problem be fixed

Simplistic Model

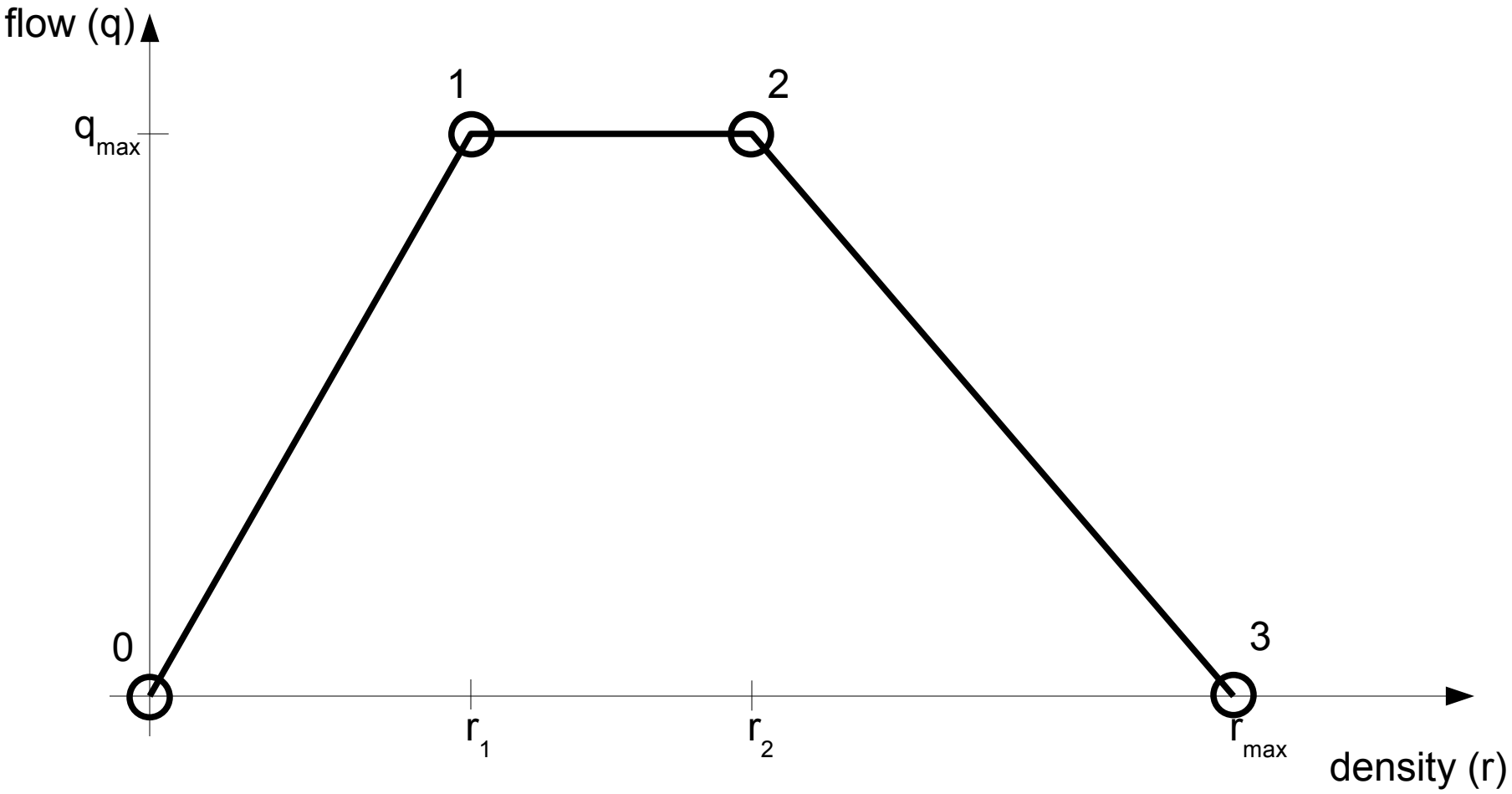


- in-flow (agents departing or entering)
- out-flow (agents arriving or leaving)
- density (~number of agents traveling)
- travel times (depend on density)

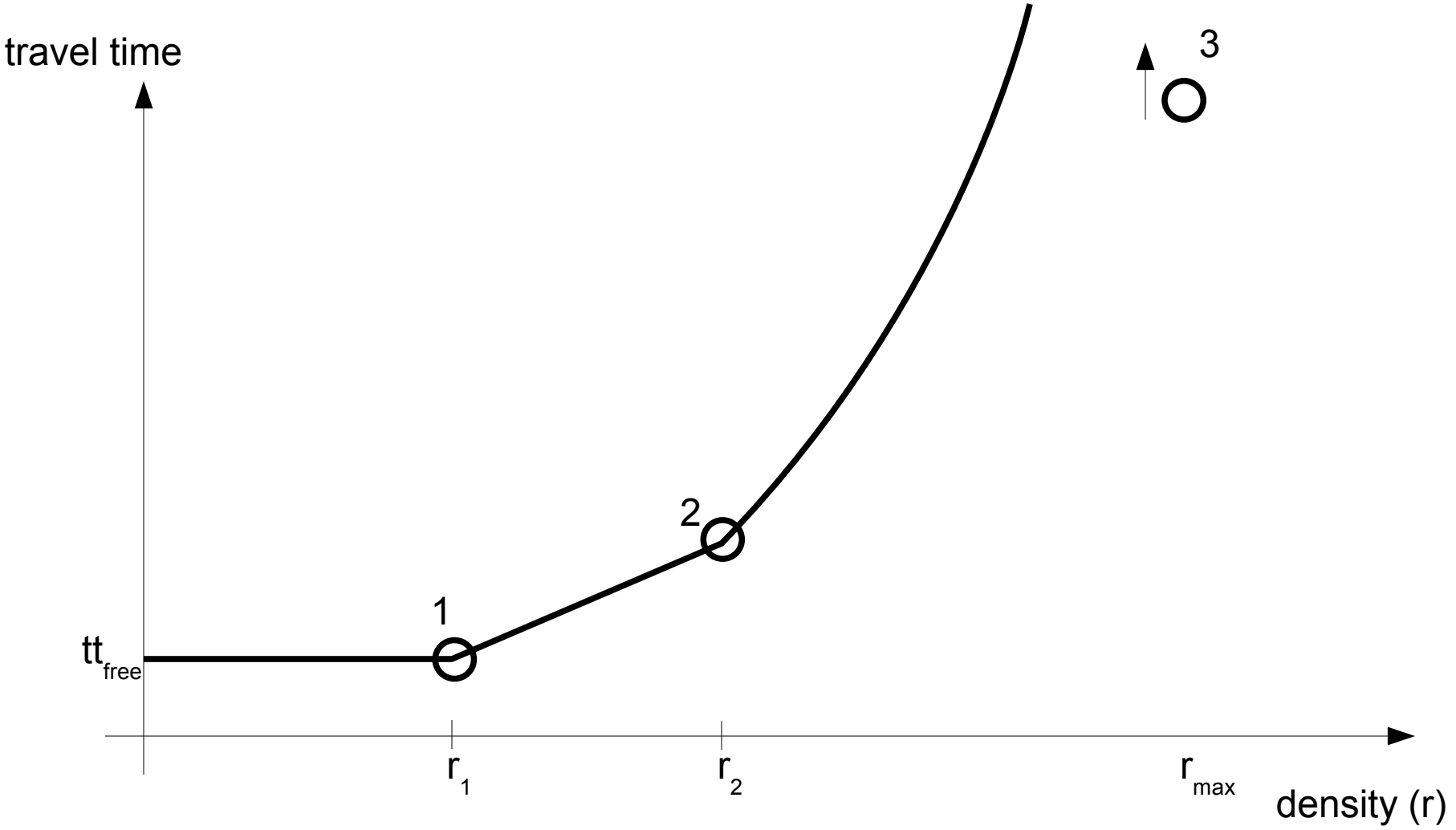
Definition of the Model

- q_{in}, in-flow defined by the agents plans
- $\frac{\mathrm{d}r}{\mathrm{d}t} \propto q_{\text{in}} - q_{\text{out}}$, growth of density
- out-flow q_{out} and speeds v are functions of r based on queue model with gaps

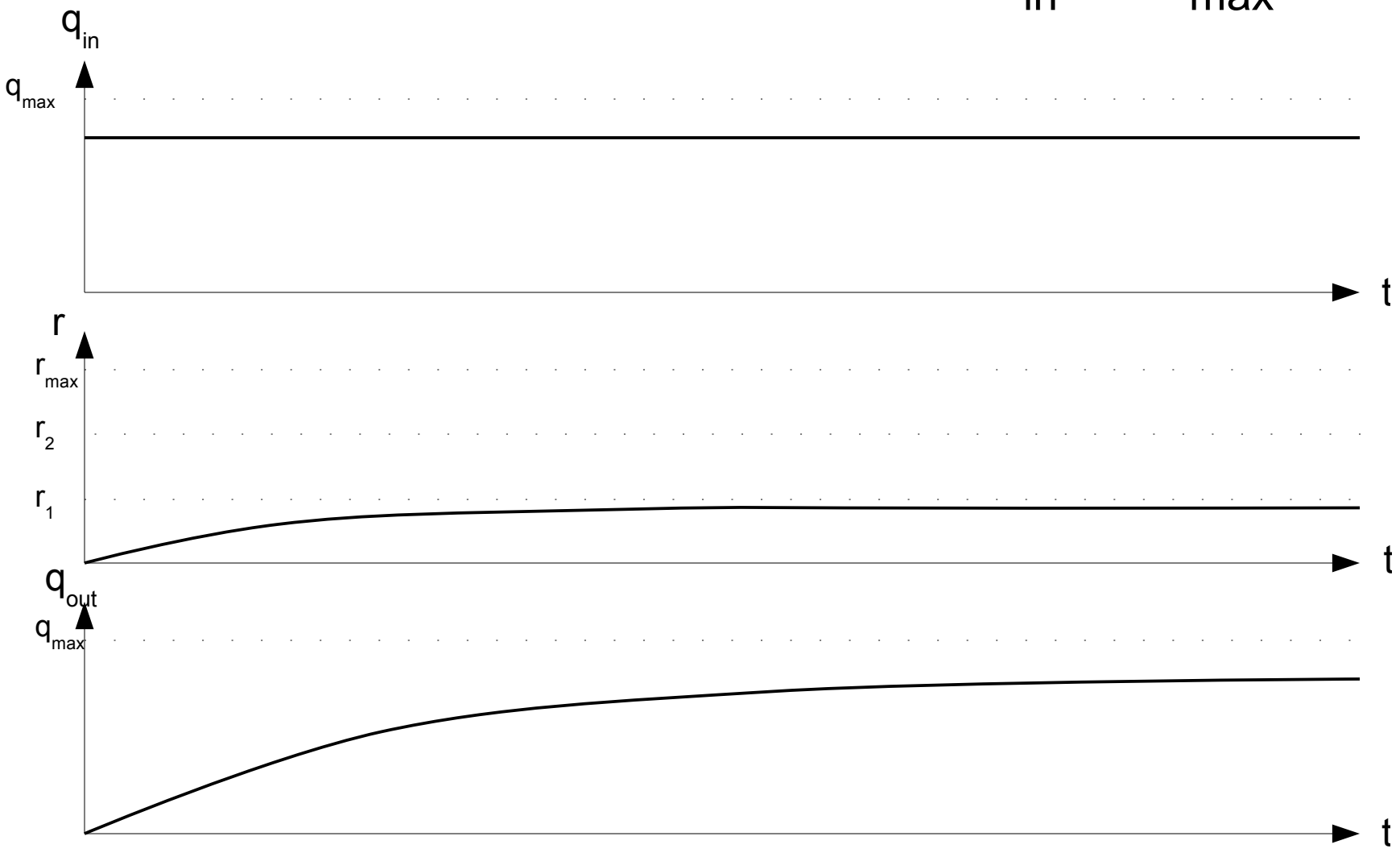
Dependency between variables: r and q_{out}



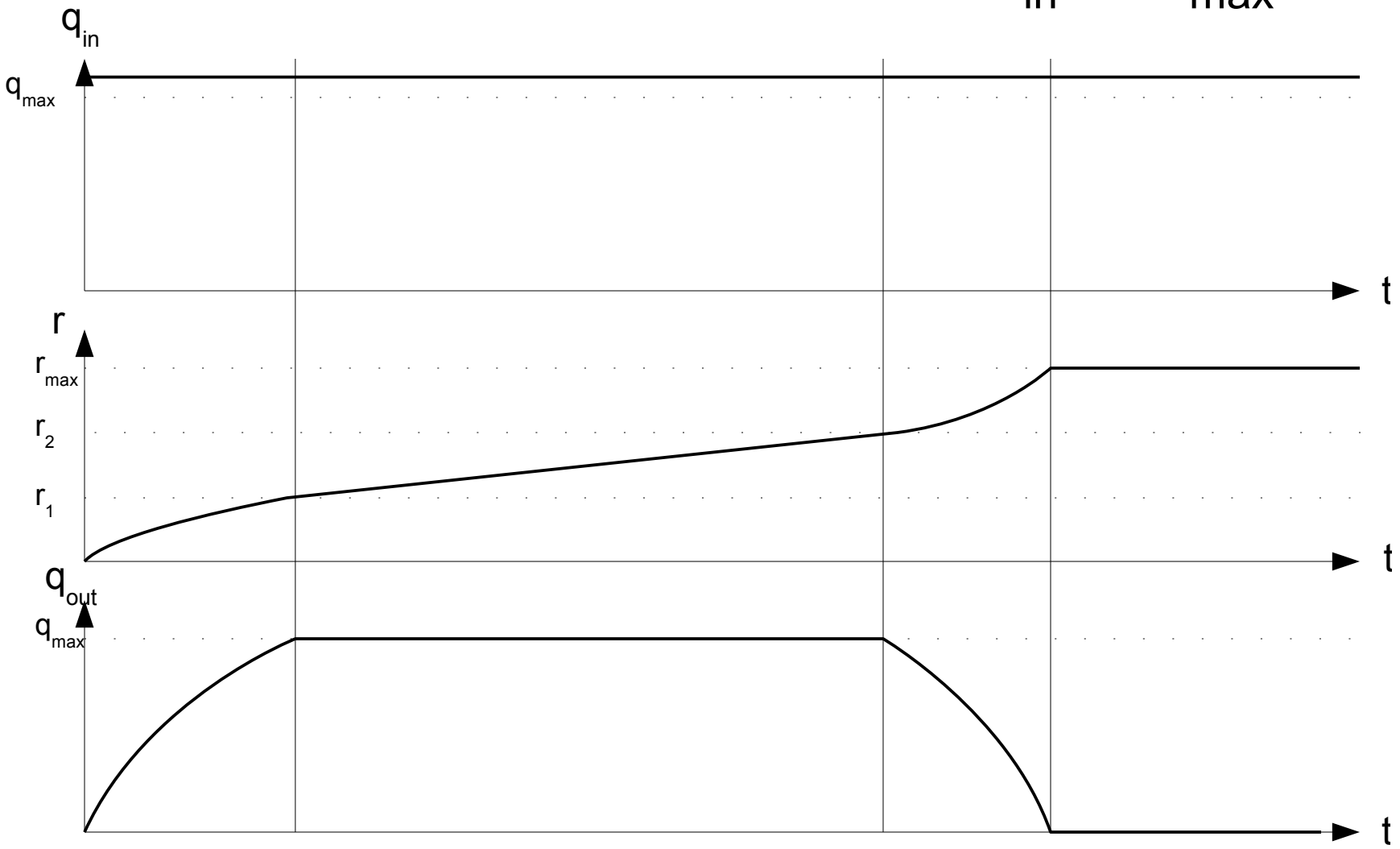
Dependency between variables: r and t



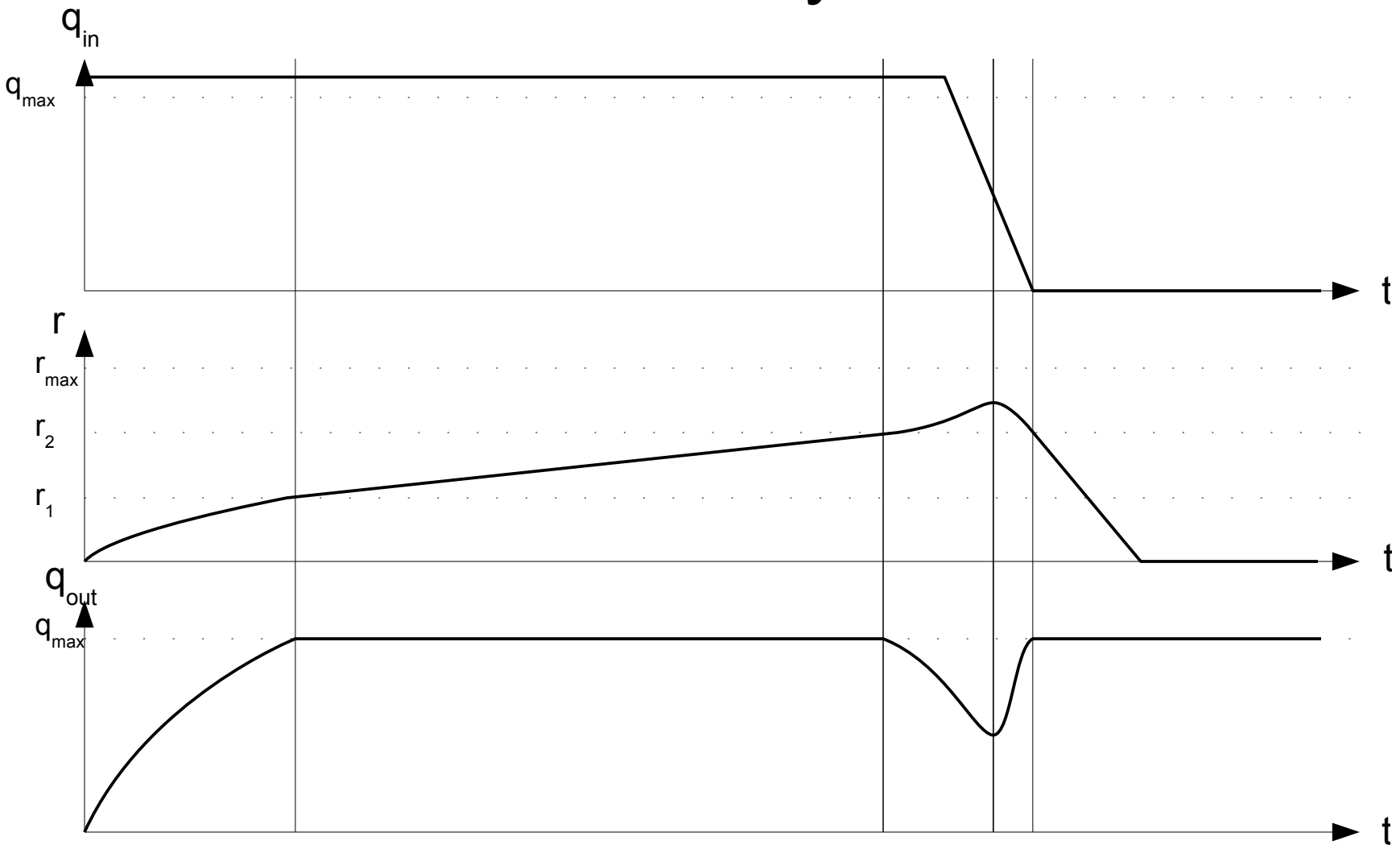
System Dynamics for $q_{in} < q_{max}$



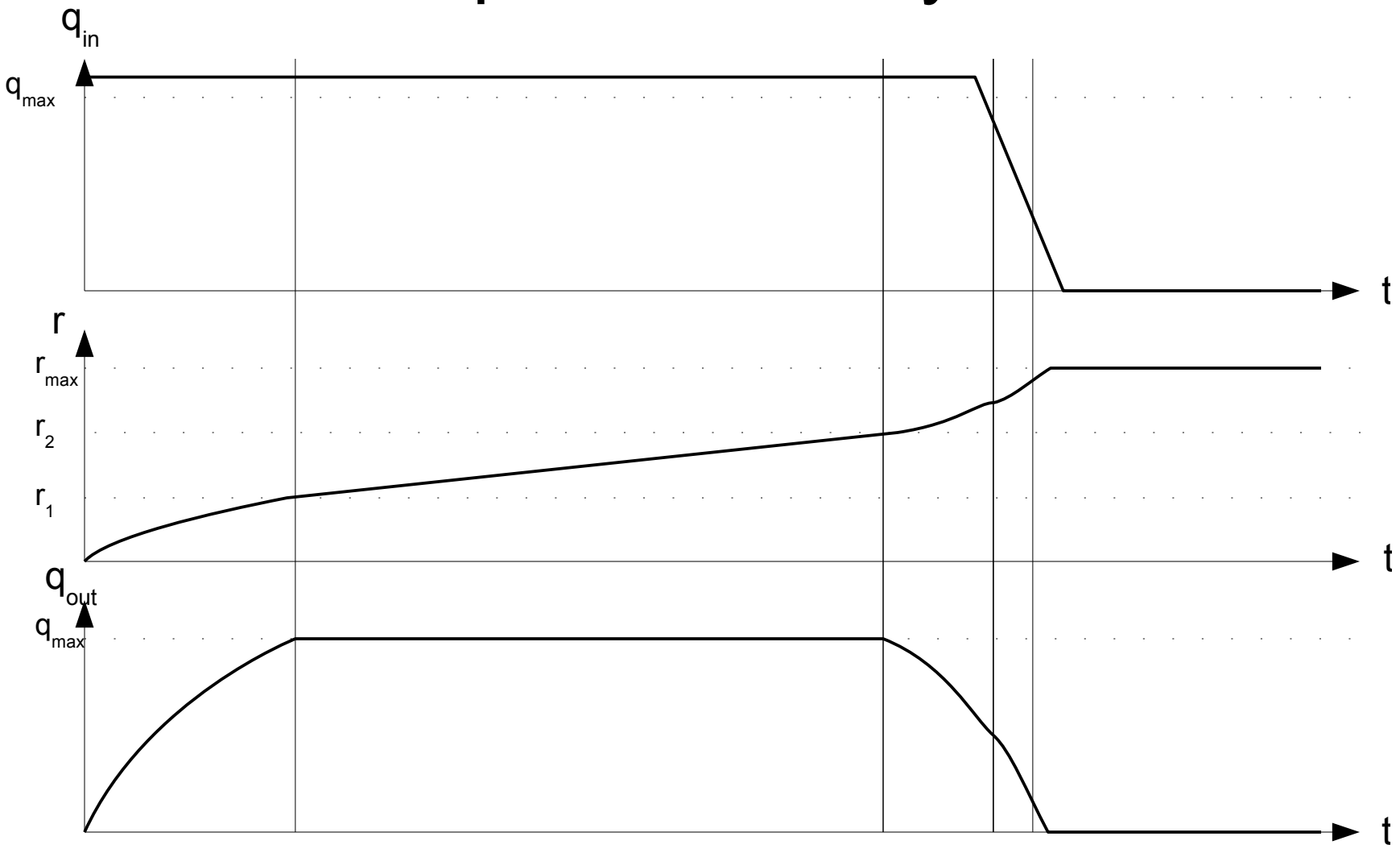
System Dynamics for $q_{in} > q_{max}$



Critical System



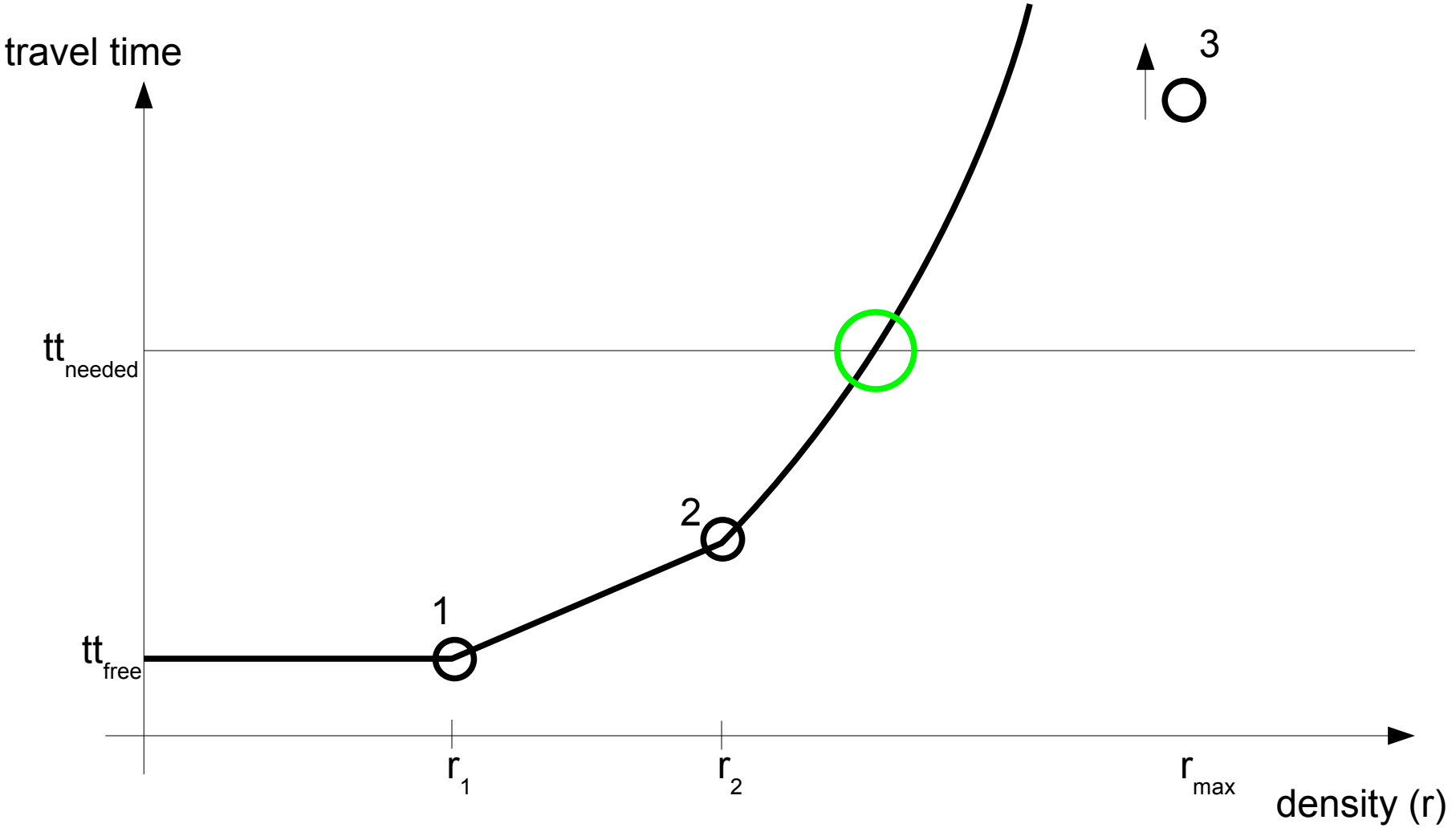
Super-Critical System



Open Question

- Why Breakdowns during leaning process?
- Not yet clear why system goes to unstable state
- Observation: We are trying to reach equal travel times on all used routes
- Assume: Travel around the core network in free conditions is much more expensive than trough it

Operating Point of the Learning Algorithm



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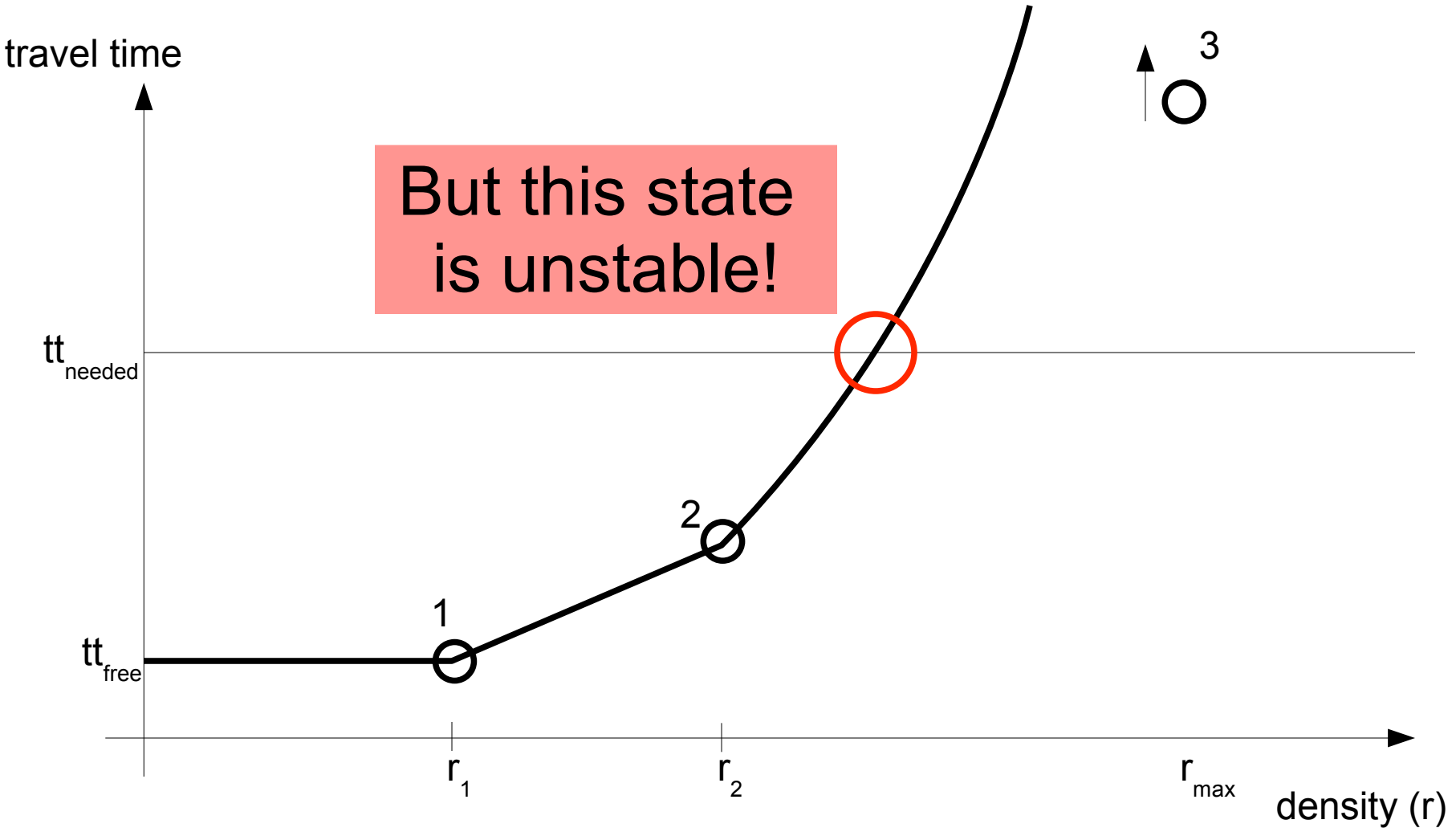
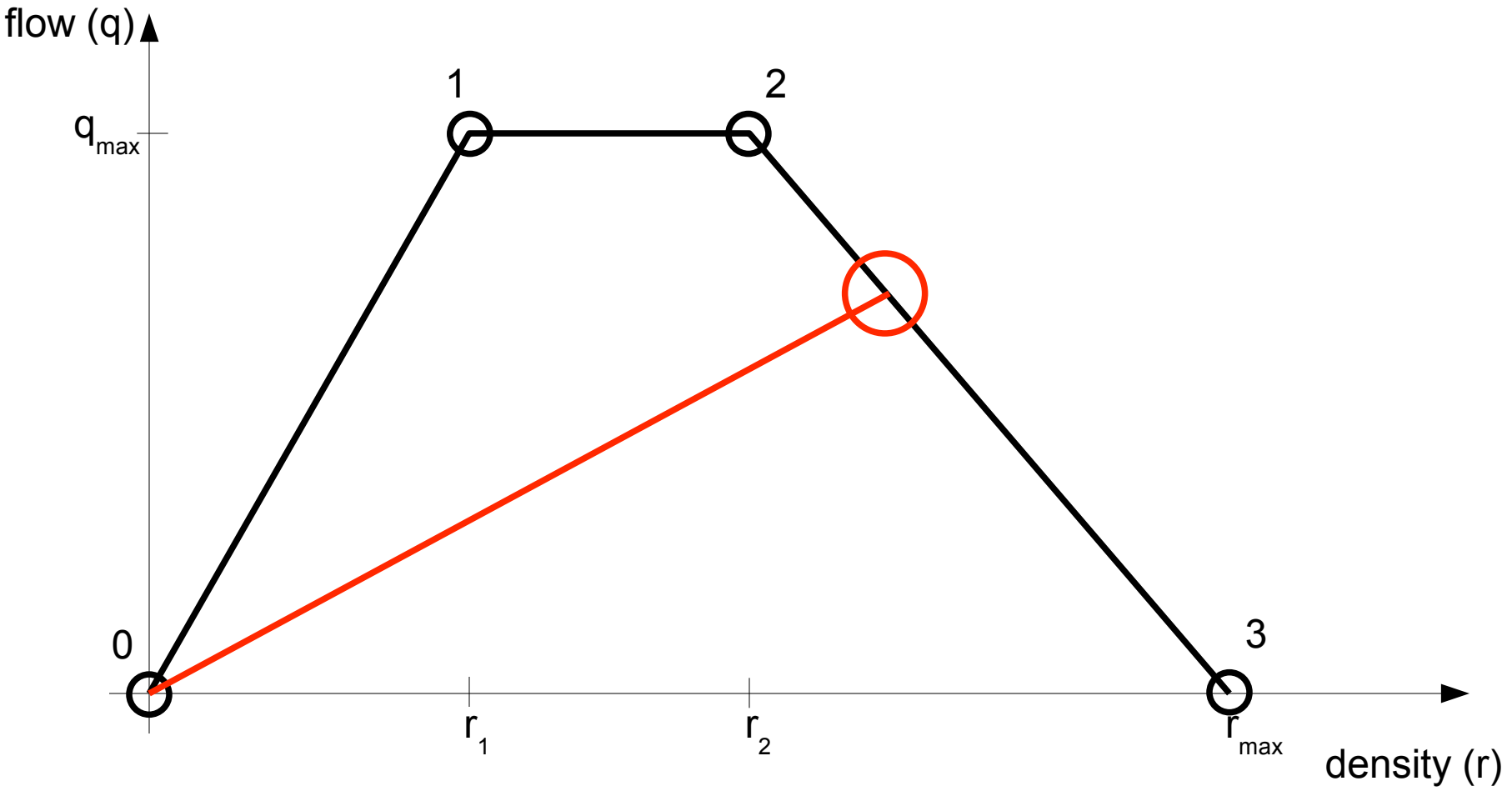
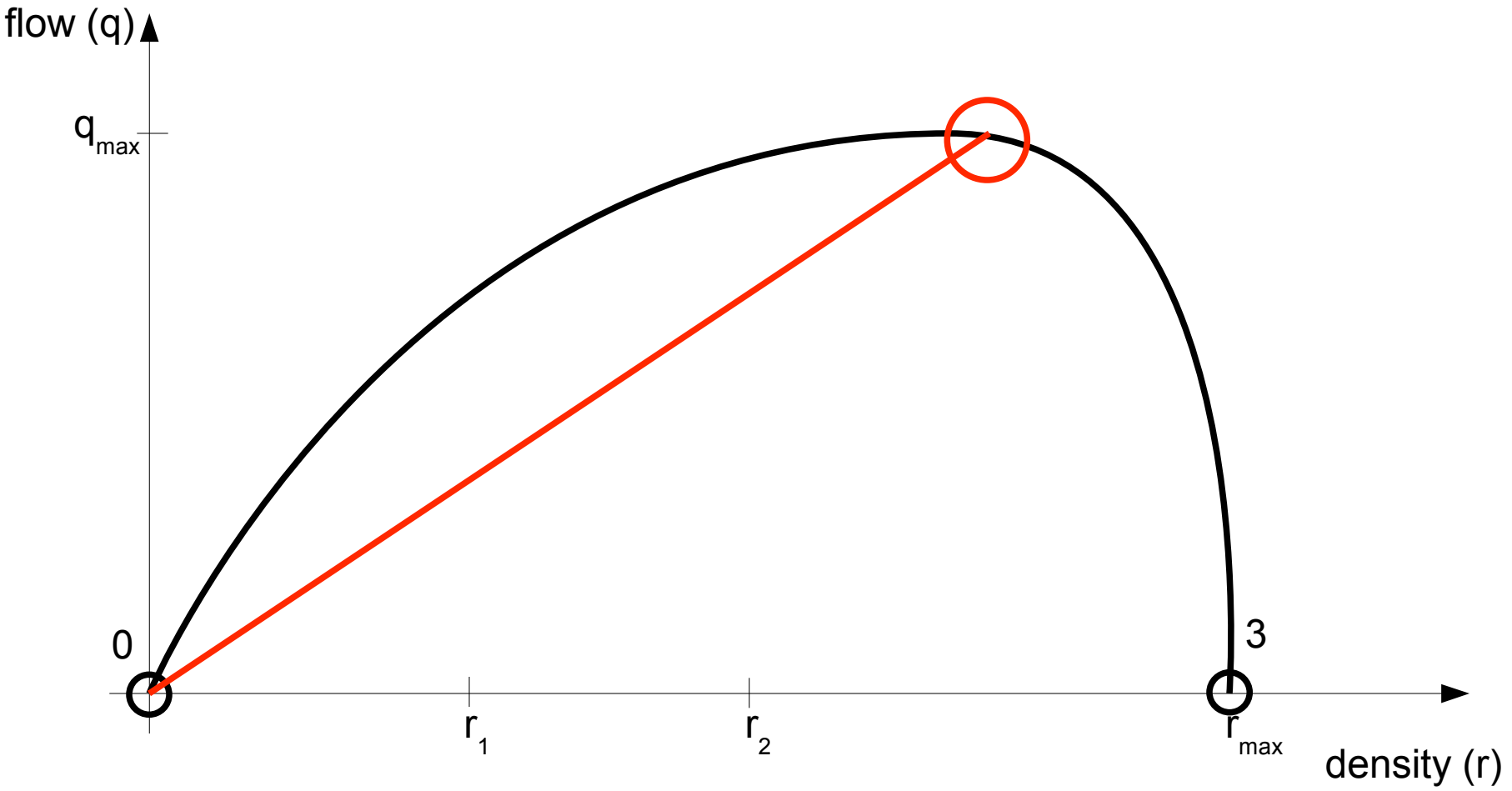


Operating Point of the Learning Algorithm(2)

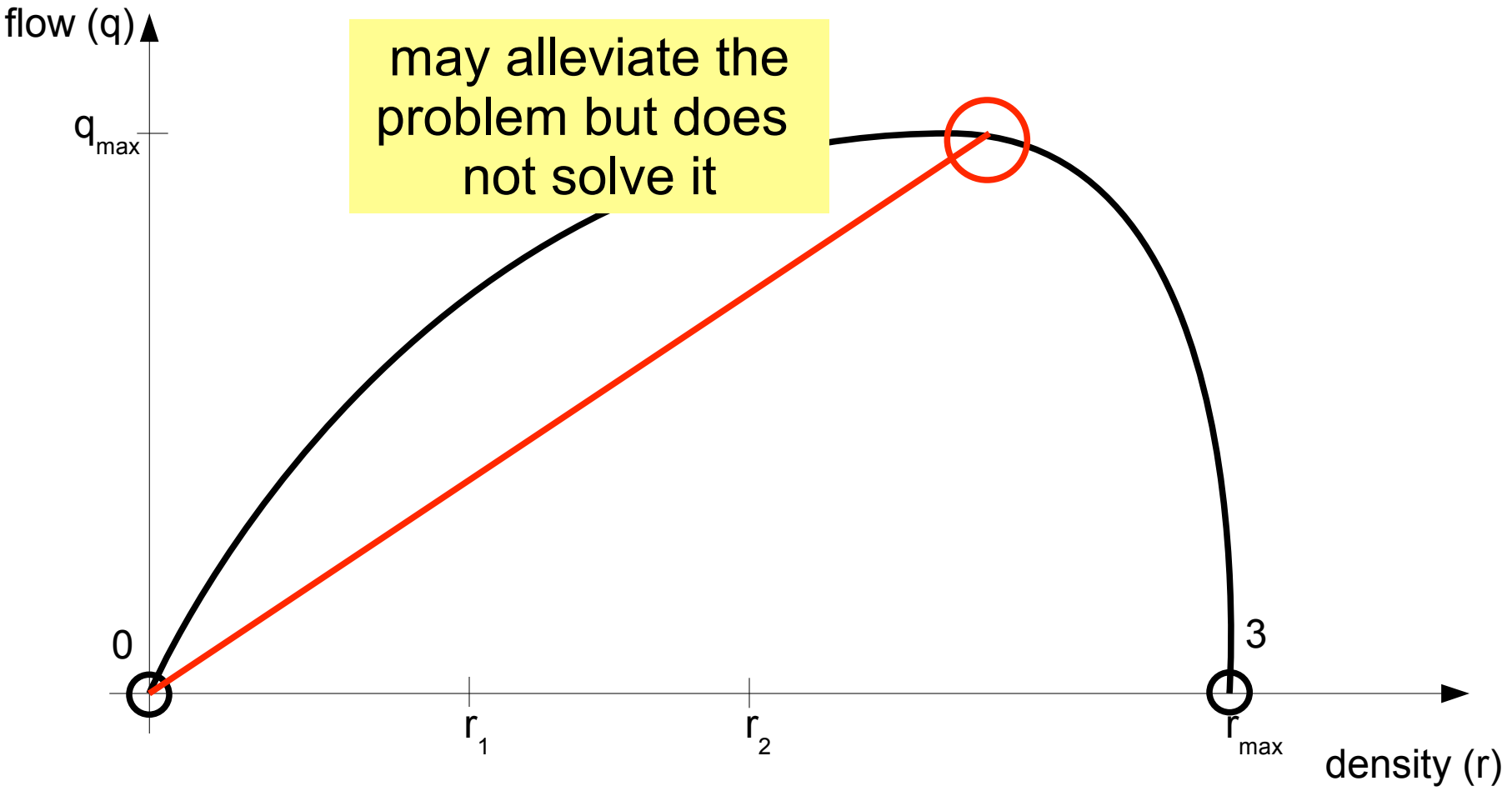


Possible Solutions

Change Characteristics of Microsimulation



Change Characteristics of Microsimulation



Agents take uncertainty into account

- Use information about breakdowns (or instability) into account for re planning
- Also means: Agents have an “inner feeling” that states with high densities are bad
- But: Do we have a chance to get the desired answer from MATSim then?

Integrate Controlling Mechanism

- Idea: Agents have access to current state of network
- Normally agents plan to use the critical part of the network
- If they hear about bad congestion they change their plans and use a detour
- -> Stabilize the system by controlling
- -> Need de facto within day replanning