5. When Minutes Matter: Simulating a Heatwave to Optimize Ambulance Routes and Hospital Capacity

Not all disasters are as physically destructive as an earthquake. A **heatwave**, as detailed in our **Vienna Use Case (Section 3.5)**, is a pervasive, "silent" disaster. It does not destroy roads, but it attacks a different and equally critical type of infrastructure: the healthcare system.

A heatwave causes a massive surge in emergency calls and hospital admissions, creating two distinct problems:

1. **Transport:** Ambulances must navigate the city to reach patients and transport them to care.
2. **Capacity:** Hospital emergency rooms become overwhelmed, leading to long wait times that can be fatal.

Our simulation model tackles both of these challenges simultaneously. It models the patient journey as a three-level graph (Section 3.5.1):

1. **Level 1:** The incident location (where the emergency call originates).
2. **Level 2:** Triage centers (if they are part of the response plan).
3. **Level 3:** Hospitals.

To solve this, the AI combines two of the methods we have discussed:

- First, it uses **Graph Theory** (as discussed in our previous post) to calculate the shortest path (fastest route) from the incident to the nearest hospitals.
- Second, it uses **Queue Theory** (as discussed in our post on bottlenecks) to analyze the "queue" at each of those hospitals.

The "self-adaptive" intelligence comes from combining these two. A simple algorithm would send the ambulance to the closest hospital. But our AI is smarter. If the simulation detects that the closest hospital's emergency room "queue" is dangerously long, the AI will dynamically reroute the ambulance to the second-closest hospital that has available capacity.

This approach optimizes the entire healthcare system, not just a single ambulance trip. It prevents one hospital from being catastrophically overloaded while another sits empty. In a crisis where every minute matters, this intelligent, adaptive resource management is essential for saving lives.