

Multi-Source Traffic Data Integration for Scalable Urban Analysis

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Motivation

Urban mobility management requires real-time fusion of heterogeneous data (Waze, NDIC, Police). However, format inconsistency and scalability limit current analytical tools. This work implements a scalable microservice back-end using ELT principles and a message broker. The resulting system features universal connectors and an extended data model, providing a robust foundation for real-time spatiotemporal traffic analysis.

System Architecture

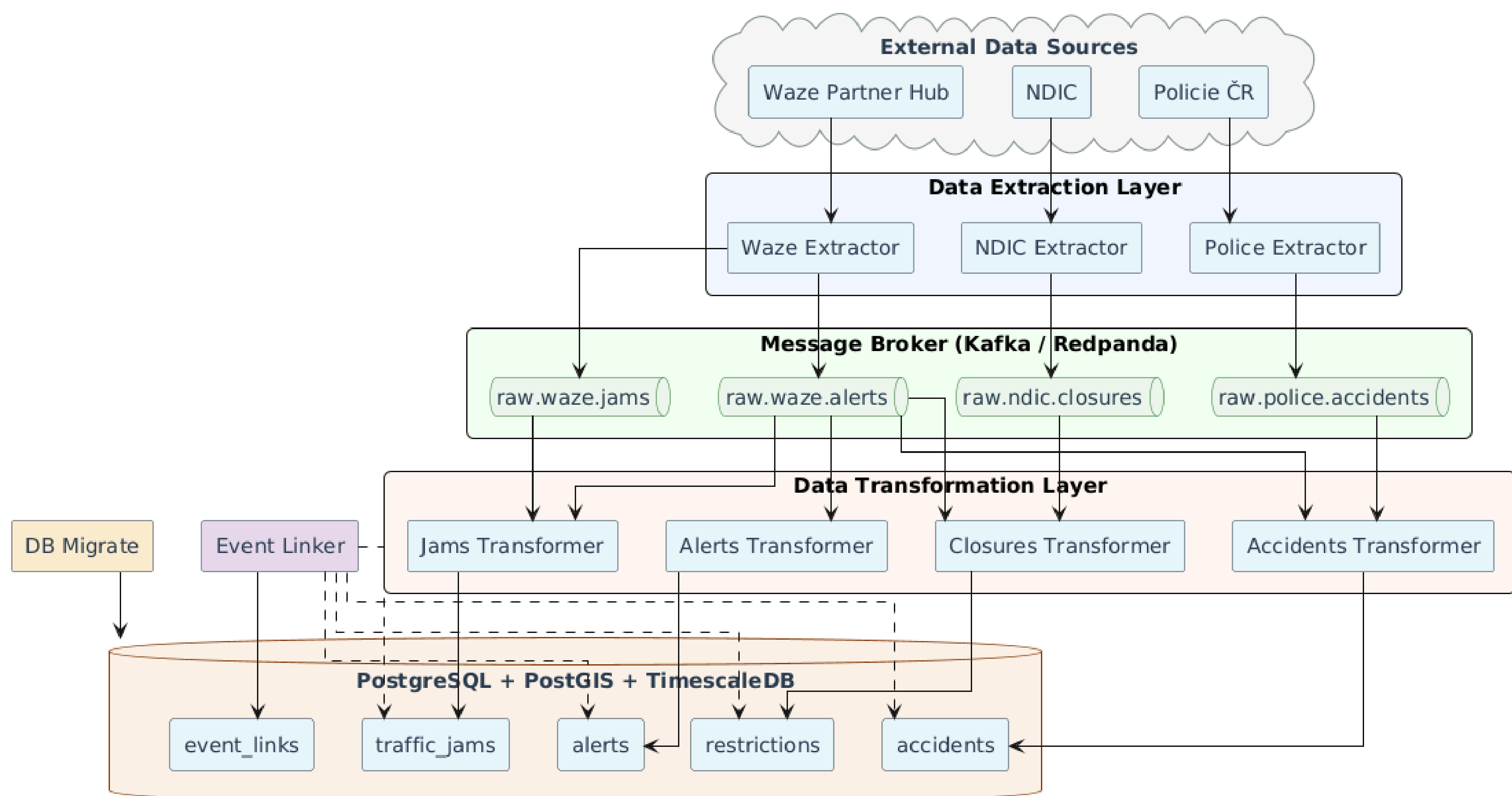


Figure 1: System Architecture Overview

Record matching

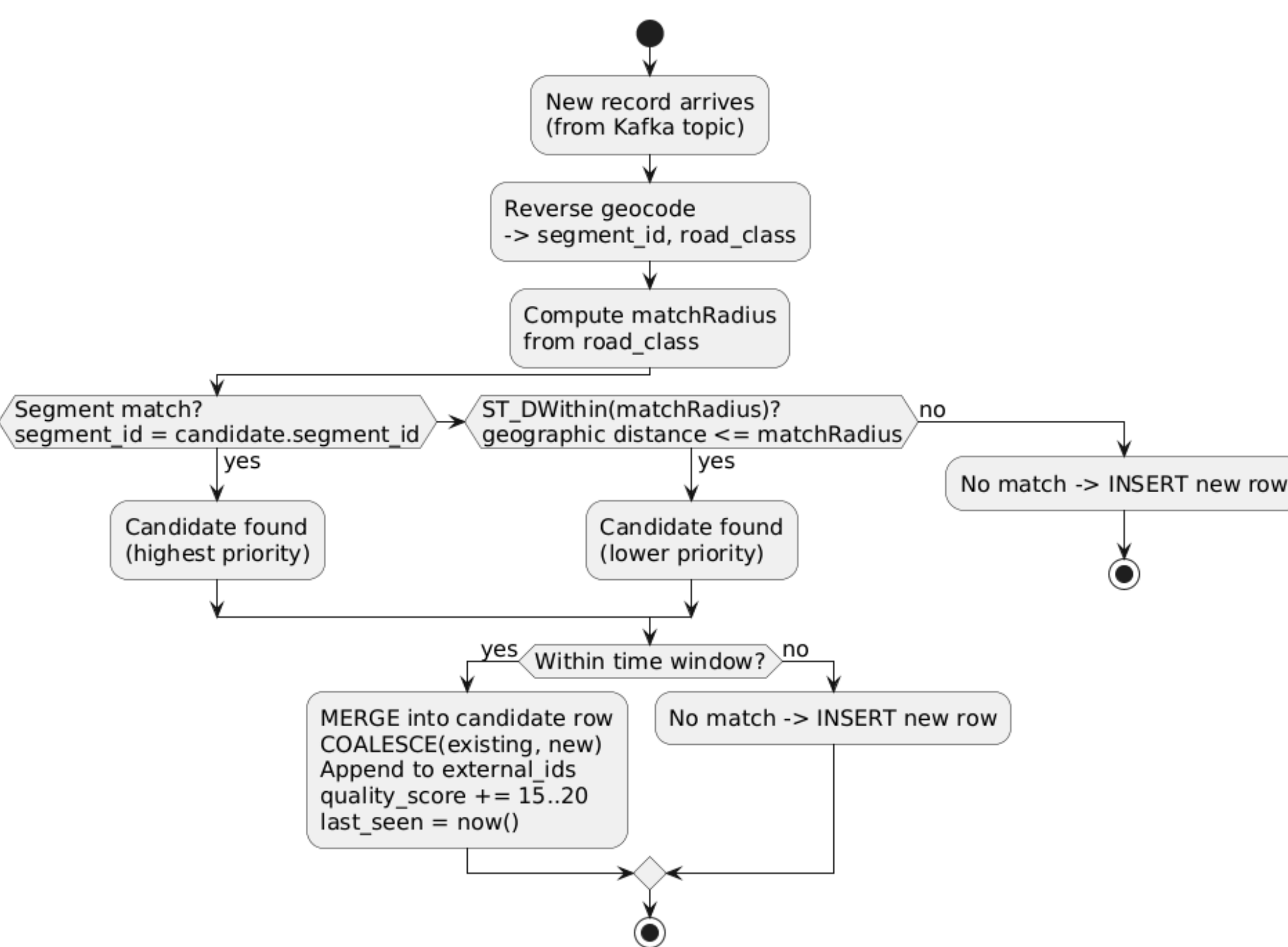


Figure 2: Matching Algorithm

Evaluation

Service	Task	n	TP	FP	Precision
accidents-transformer	Merge Waze × Police	148	137	11	92.6 %
jams-transformer	Merge JAM × alert	183	142	41	77.6 %
closures-transformer	Merge Waze × NDIC	50	39	11	78.0 %
event-linker: acc→jam	Causal link	170	167	3	98.2 %
event-linker: restr→jam	Causal link	29	28	1	96.6 %
event-linker: alert→jam	Causal link	8	5	3	62.5 %

Table 1: Summary of Results from Manual Evaluation

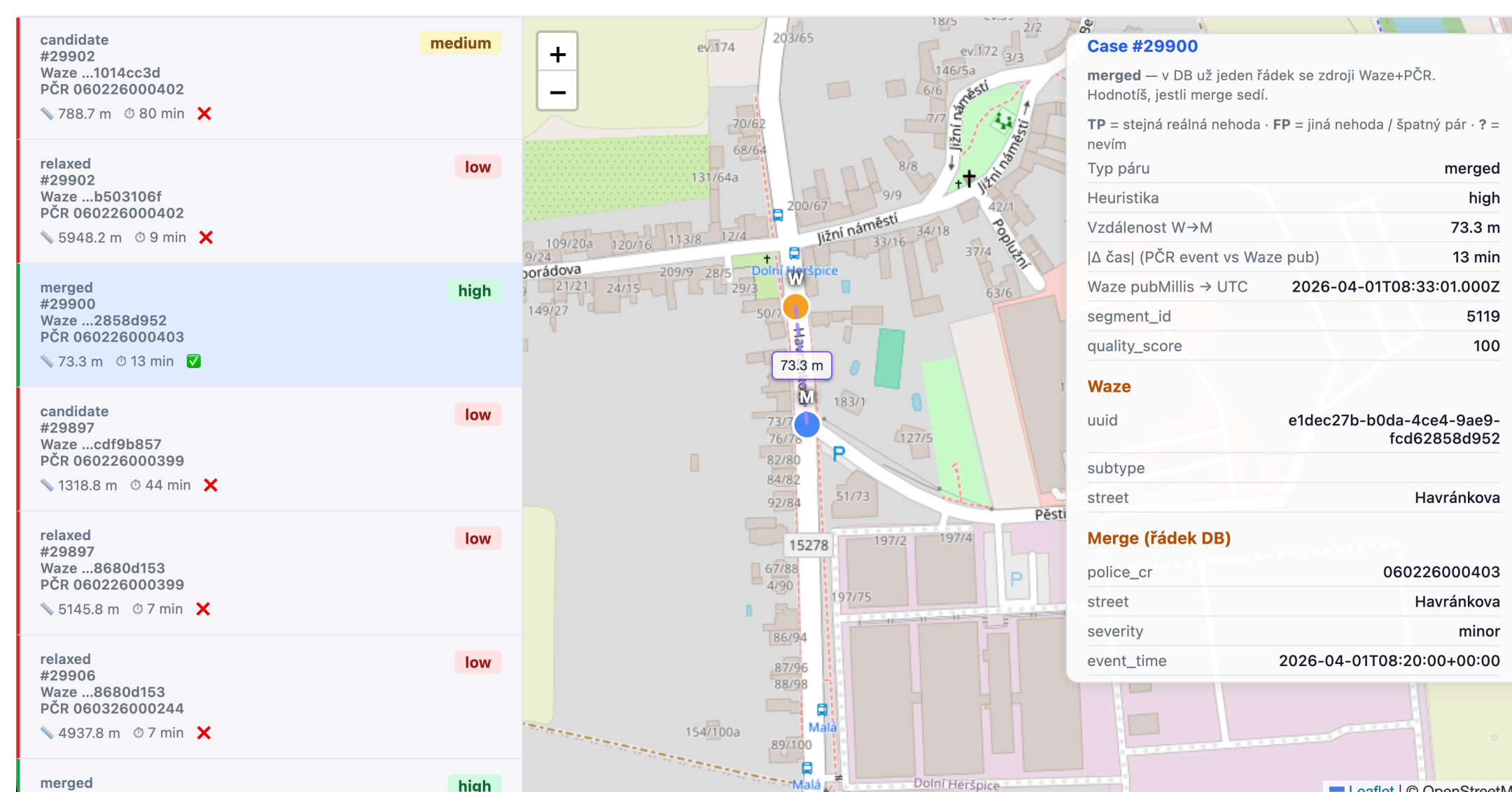


Figure 3: UI for Manual Evaluation