PARALLEL QUERY ENGINE FOR INTERACTIVE SPATIOTEMPORAL ANALYSIS

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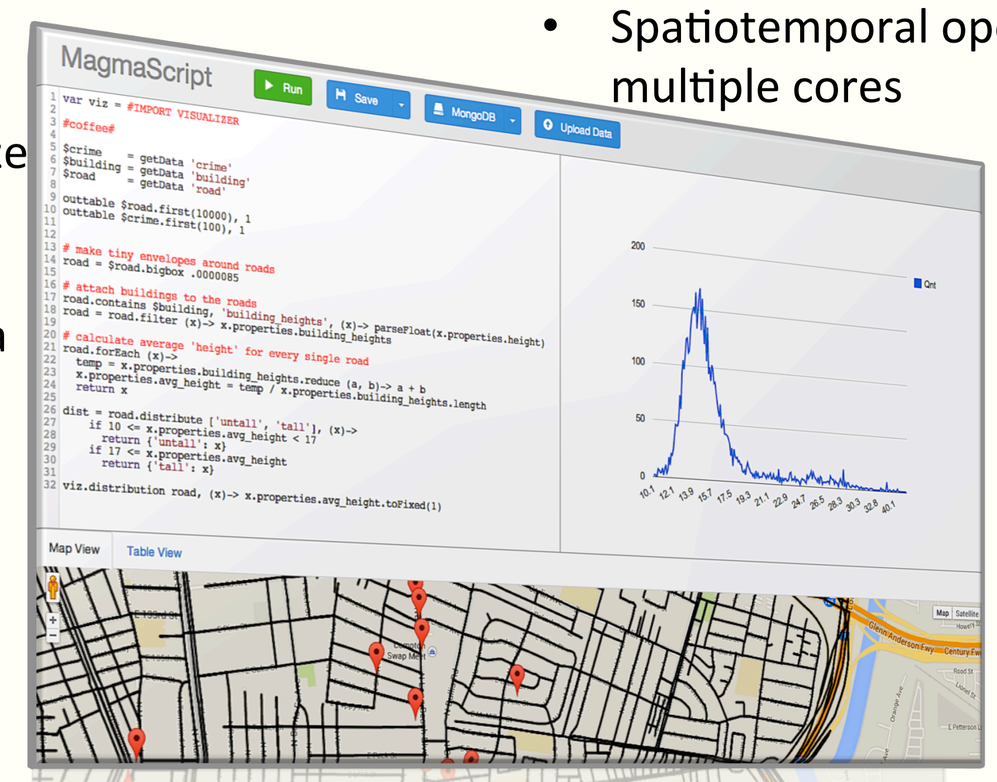
What is this?

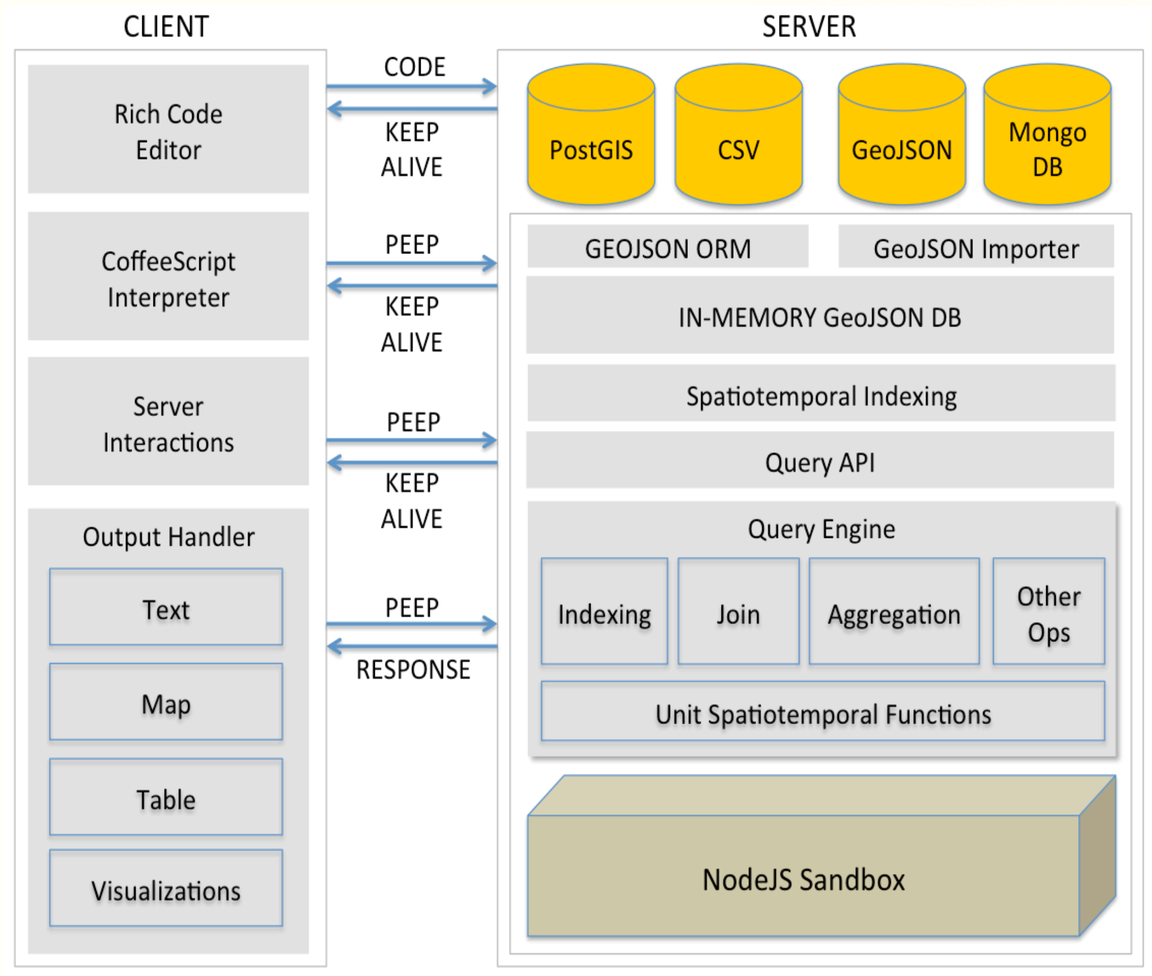
- Integrated scripting tool for flexible and fast prototyping
- Import, clean, transform, visualize and export data with simple scripts
- Go back and forth with your data for incremental research. Save and restore previous states.
- Machine learning, NLP, custom visualizations… anything is possible with an extension!

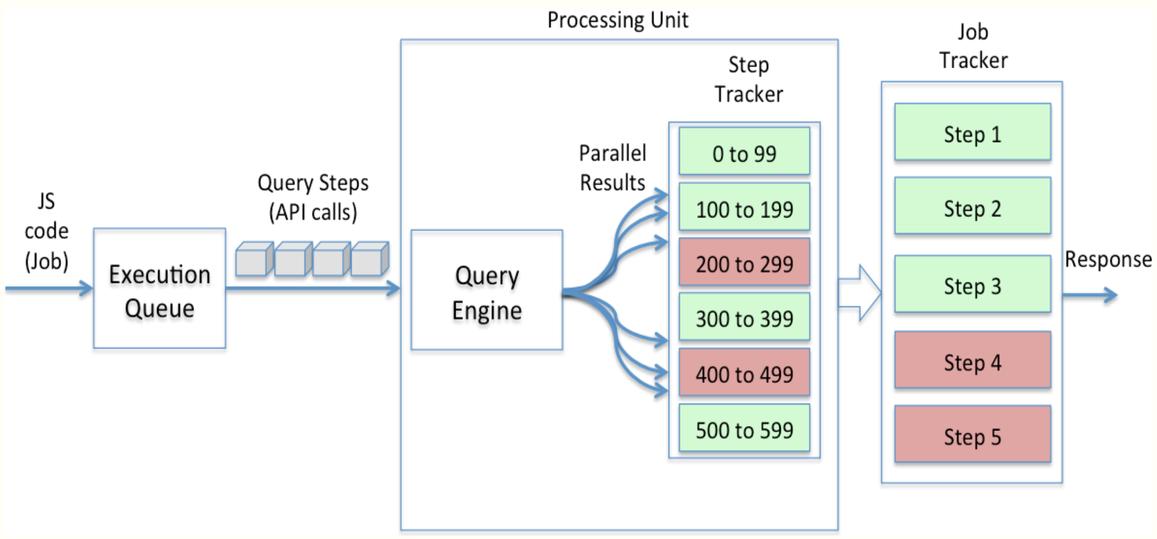


Why here?

- Highly optimized for spatiotemporal operations
- In built in-memory indexing with R-trees (space) and interval trees (time)
- Speedy execution of spatiotemporal operations like joins, bucketing and aggregations
- Visualize your geospatial data on maps with one line code. Create your own visualizations.

Architecture





Speed-Up

- Spatiotemporal operations execute in parallel on multiple cores
- This speed-up combines with in-memory spatiotemporal indexing to provide low response times
- Parallelization is optimized according to size of data and number of cores
- We have process level caching of data and indexes to avoid repeated loading of datasets making efficient use of available memory to save time

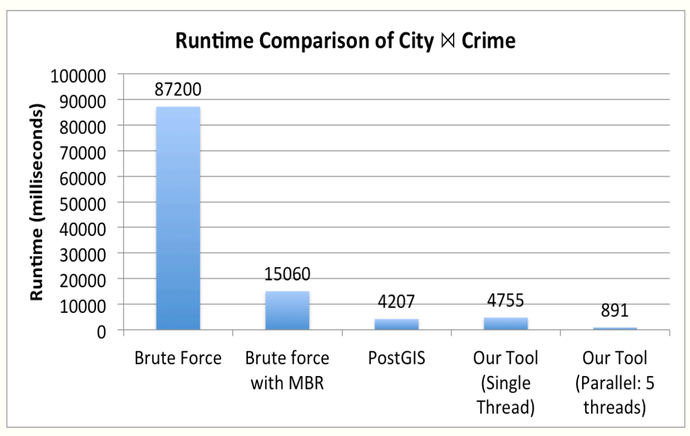
Experiment

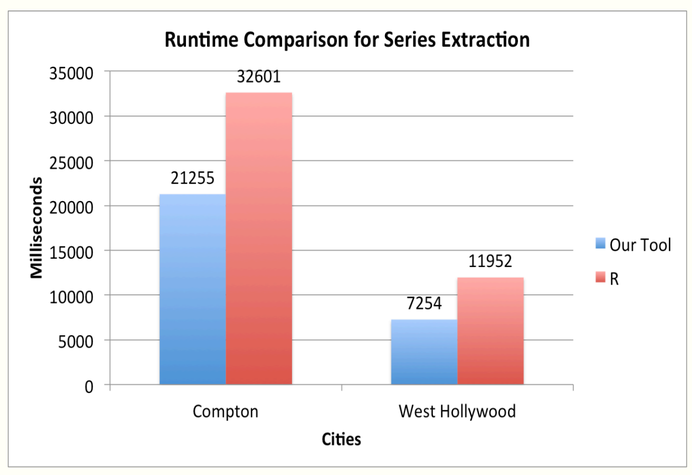
- Identifying spatiotemporally co-occurring crime patterns in cities Compton and West Hollywood in Los Angeles county
- We joined the crimes with all cities in LA county to compare performance in spatial joins with postGIS
- We searched inside every crime's bounding box to find spatially nearby crimes and then filtered them temporally to get series of co-occurring crimes
- We then used apriori algorithm to find the set of crimes that occur most frequently together in both cities

Association Rule (Compton)	Support
Assault, Aggravated Assault, Vehicle/Boating Laws	23.86%
Theft/Larceny, Vehicle break-in/Theft, Assault	22.13%
Assault, Grand Theft Auto, Motor Vehicle Theft	20.61%

Result

- Our tool in parallel mode showed a major improvement over brute force and indexed postGIS spatial join





- We also outperformed spatial R in executing the co-occurence algorithm (see the charts)
- We do not claim to be a replacement for these tools; but a smart and efficient way to perform advanced spatiotemporal research and prototyping on reasonable sized data