Bringing Long Running Geostatistical Calculations to Public Health Professionals in the Developing World

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On Geostatistical Methods For Neglected Tropical Disease Research

Coming up…

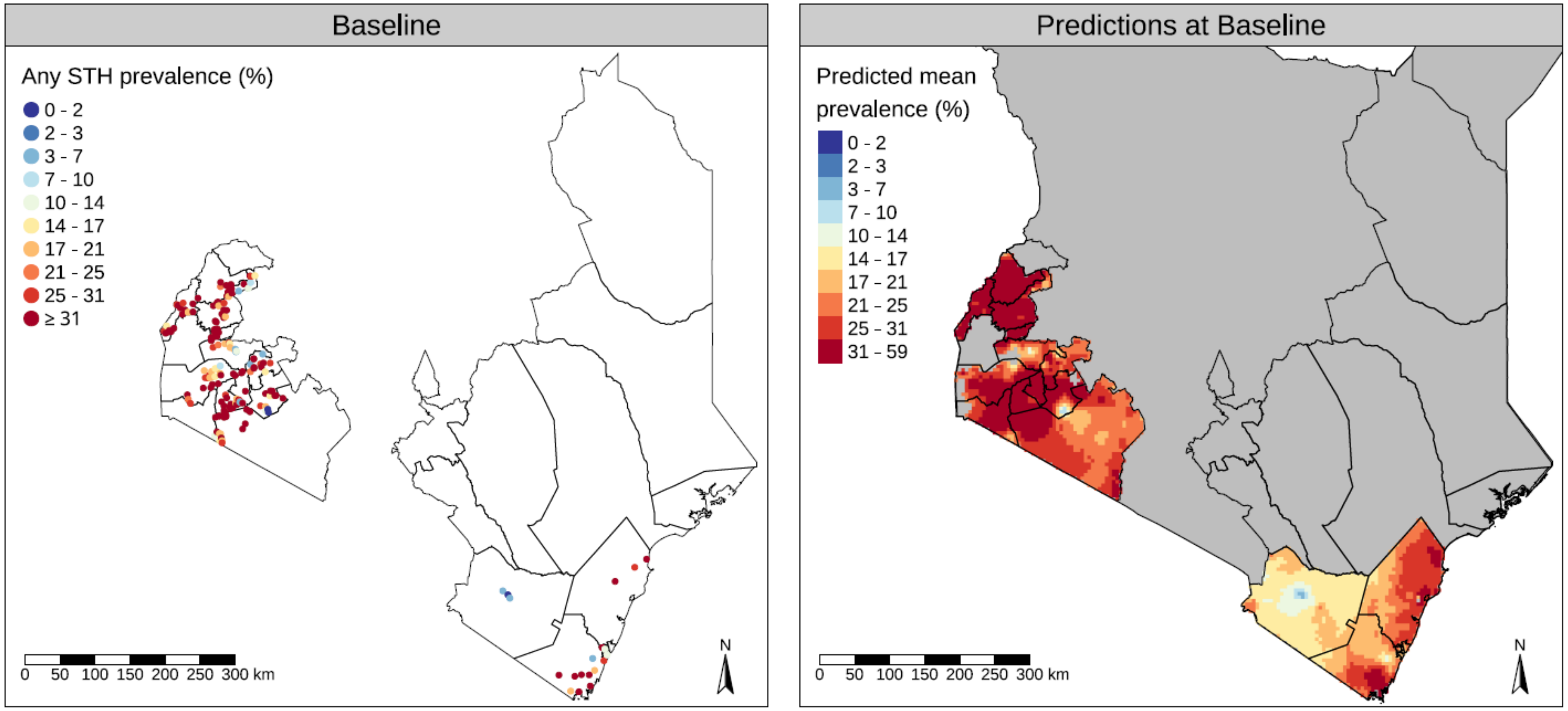
- The Science
- The problem
- Proposed Architecture
- Current Prototype

The Science – NOT MY WORK!

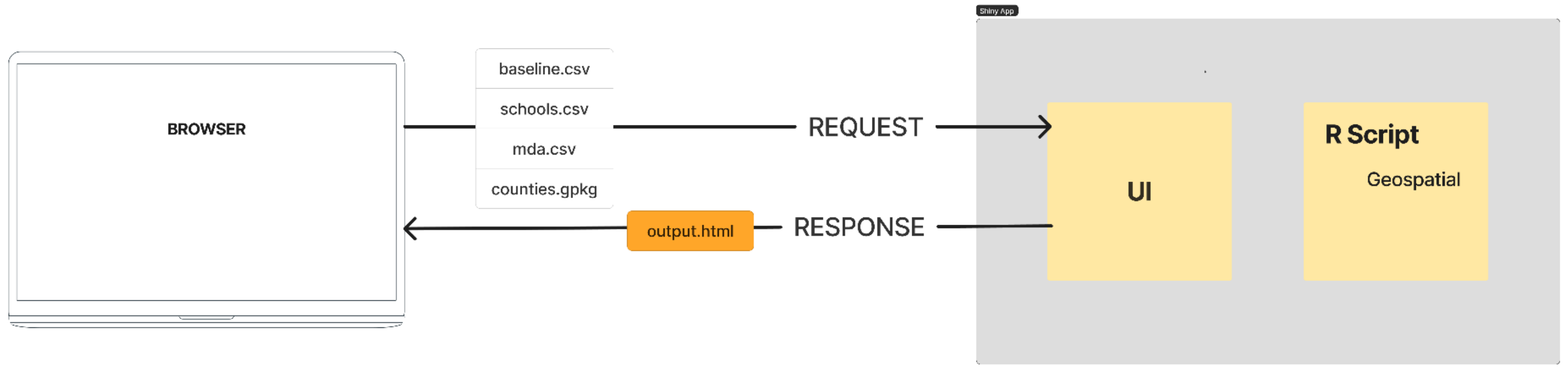
- “**Neglected Tropical Diseases**” are a set of 7 serious diseases affecting developing countries. The WHO has a **target to eliminate** 7 of these diseases by 2030.
- Statisticians in our team have developed **geostatistical methods*** of analysing prevalence data of cases of each of these NTDs.
- In short the methods are key for designing **efficient surveys**
- We need to make these calculations available as a **web application** to health workers in the developing world.

*e.g. Claudio Fronterre and others, Design and Analysis of Elimination Surveys for Neglected Tropical Diseases, *The Journal of Infectious Diseases*, Volume 221, Issue Supplement_5, 15 June 2020, Pages S554–S560, https://doi.org/10.1093/infdis/jiz554

Survey Design 😃



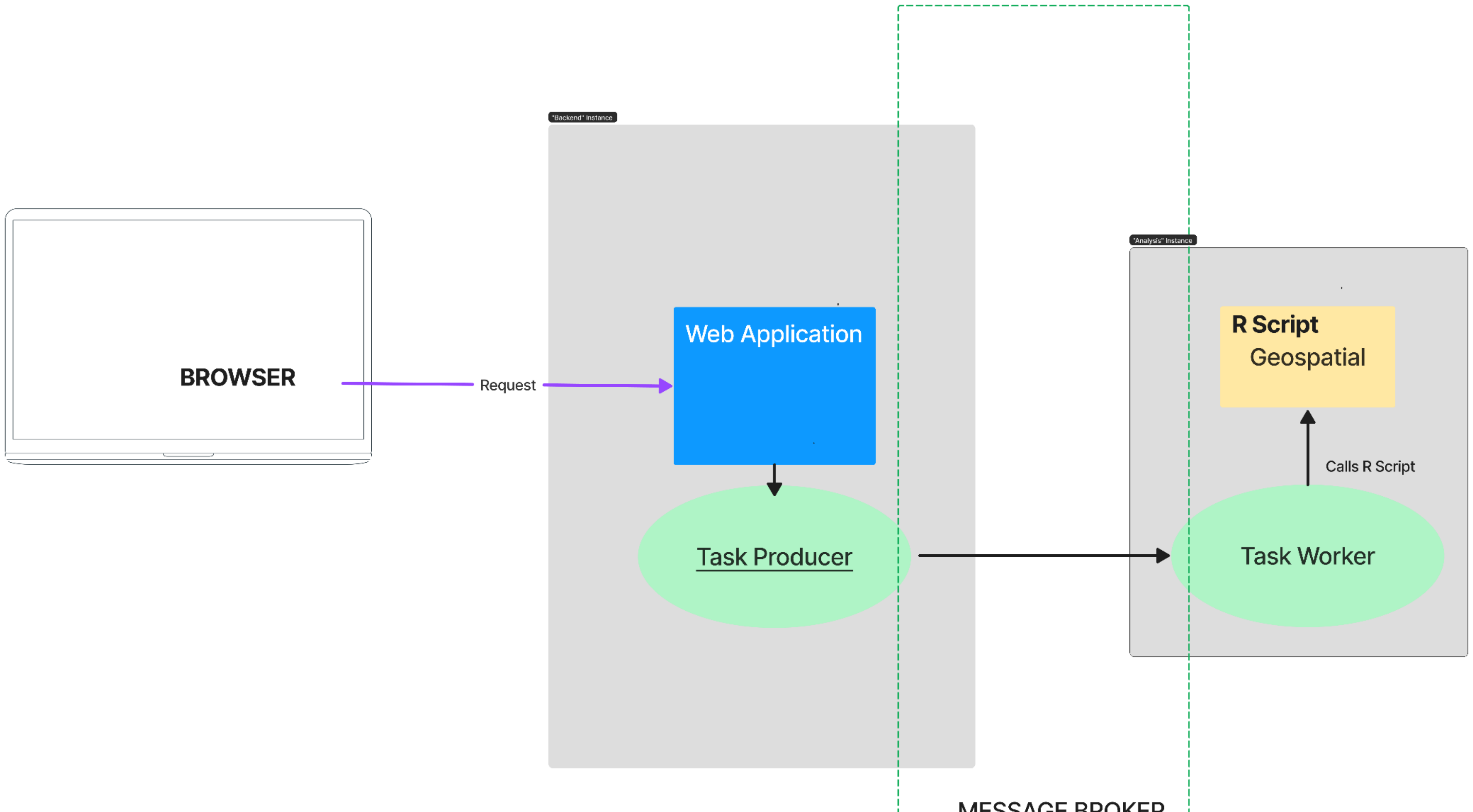
Existing “R Shiny” Application



The Technical Problem

- Geospatial Calculations are very long-running: these can run for hours.
- Difficult to scale satisfactorily with a Shiny App
- Need to be able to run a range of different analysis calculations
- Need a bespoke web application and a way to send notifications to the user

Using a Message Broker as a Task Queue



Message Broker

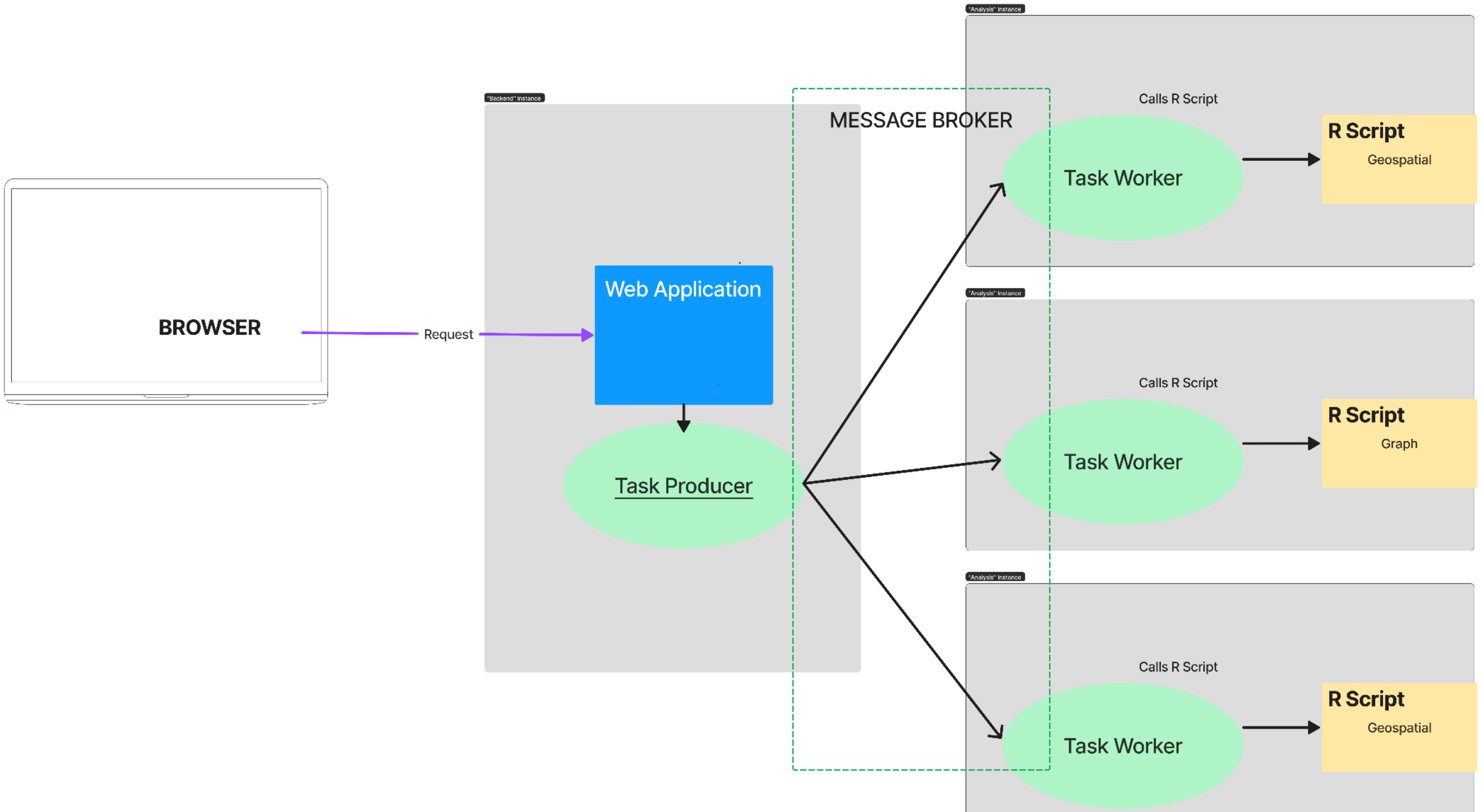
According to IBM:

“A message broker is software that enables applications, systems, and services to communicate with each other and exchange information.”

According to VMWare:

“Asynchronous messaging allows producers and consumers to send and receive messages independently and at different times without blocking.”

Scaling Up Using a Message Broker

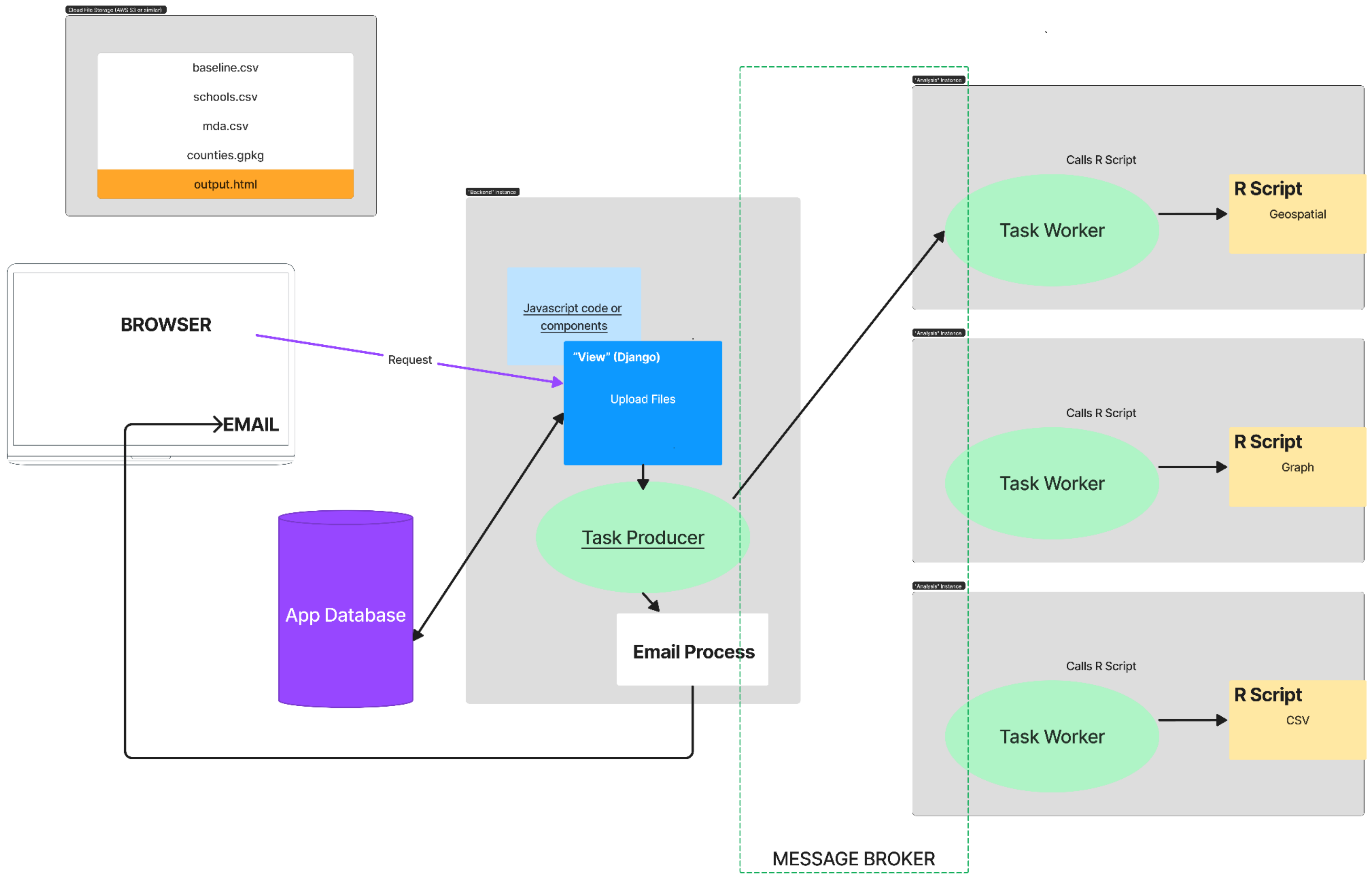


Asynchronous Processing

A Message Broker:

- Typically provides a Message Queue which can act as a task queue in our scenario
- Can allow our processes to communicate even when one process temporarily goes down
- We can scale up the number of “workers” running our calculations without affecting the web application
- We can have as many message queues as is required; one per different analysis code (R Script) that needs to be run

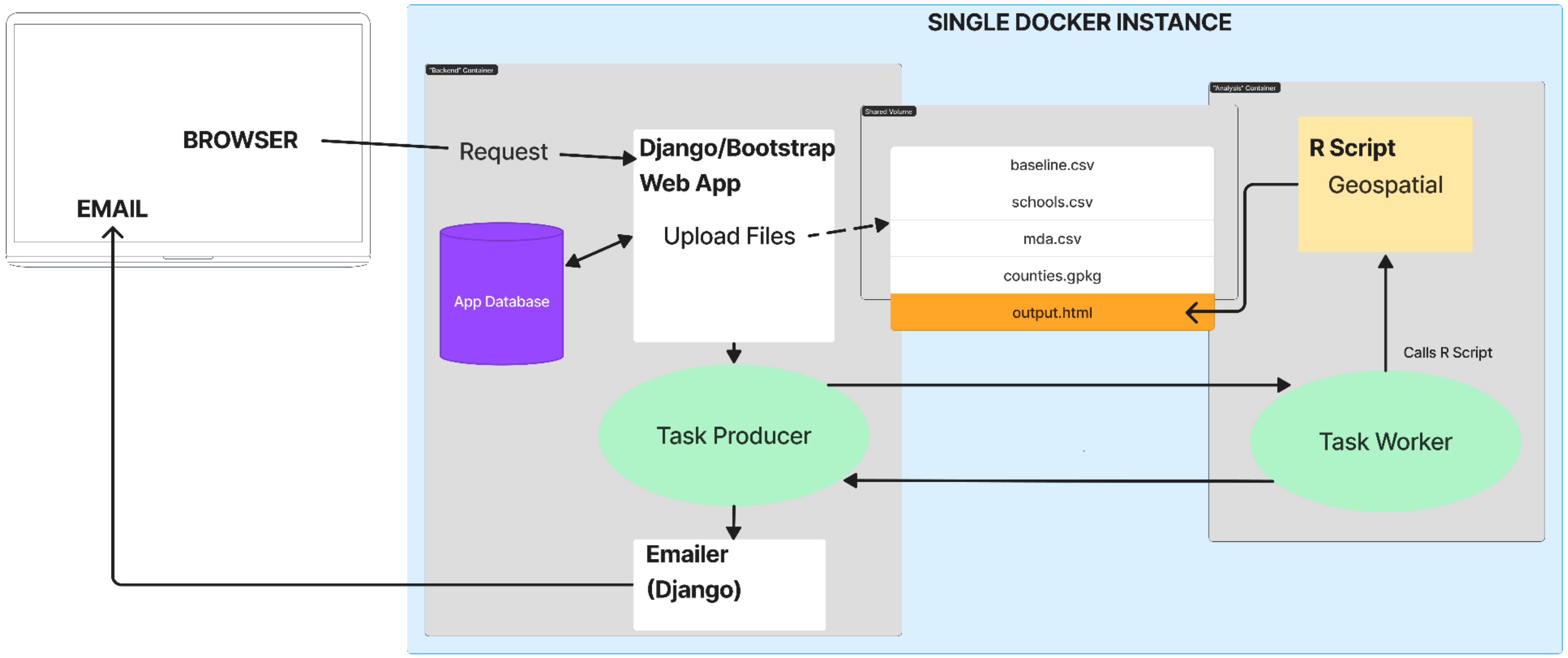
Proposed Architecture



Main Components

- Django web application for user interaction
- Database (for user details, sessions, historical results etc)
- Message broker (REDIS or similar) with message queues configured for each different analysis script
- The Web Application interfaces with the message broker via the Python Celery library
- Cloud storage for files that are inputs/outputs of the analysis

Current Prototype



Where We Are…

- All processes running within a single virtual machine (and a single Docker instance)
- Different containers for different components
- As a “cheat” we currently store data files inside a shared Docker volume (that all processes can access via a mounted file system)

Open Source?

- To open source the application we would need a truly flexible interface between web application and analysis script
- Specification of the list and types of parameters plus any web-tier validation would be in configuration not code
- By exploring the universe of likely processes we can get a good sense of how to specify this configuration