Developing standards and systems for MOOC data science

Kalyan Veeramachaneni, Franck Dernoncourt
Colin Taylor, Zach Pardos, Una-May O'Reilly

Any Scale learning for All
CSAIL, MIT

Overview

- Background and motivation
  - What did the data looked like?
  - Where are the bottlenecks?
- Data science @ scale
  - Organize- MOOCdb
  - Create multiple views- MOOC En Images
  - Provide APIs- MOOCdb Access
- Why standardize?

What did the data look like?

MOOC

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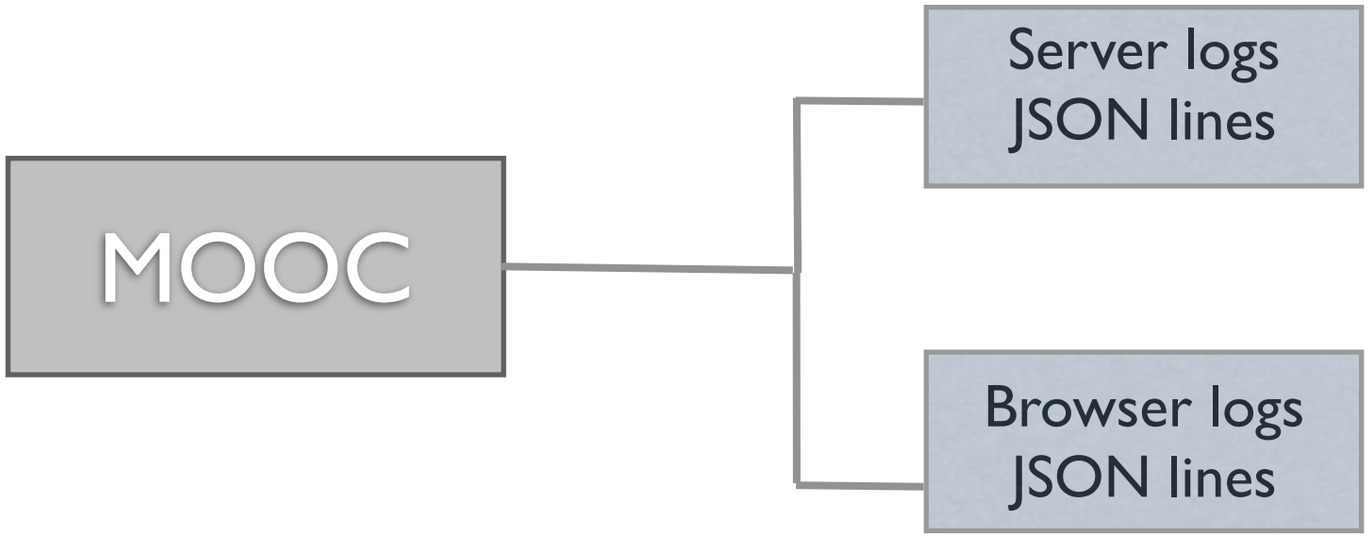

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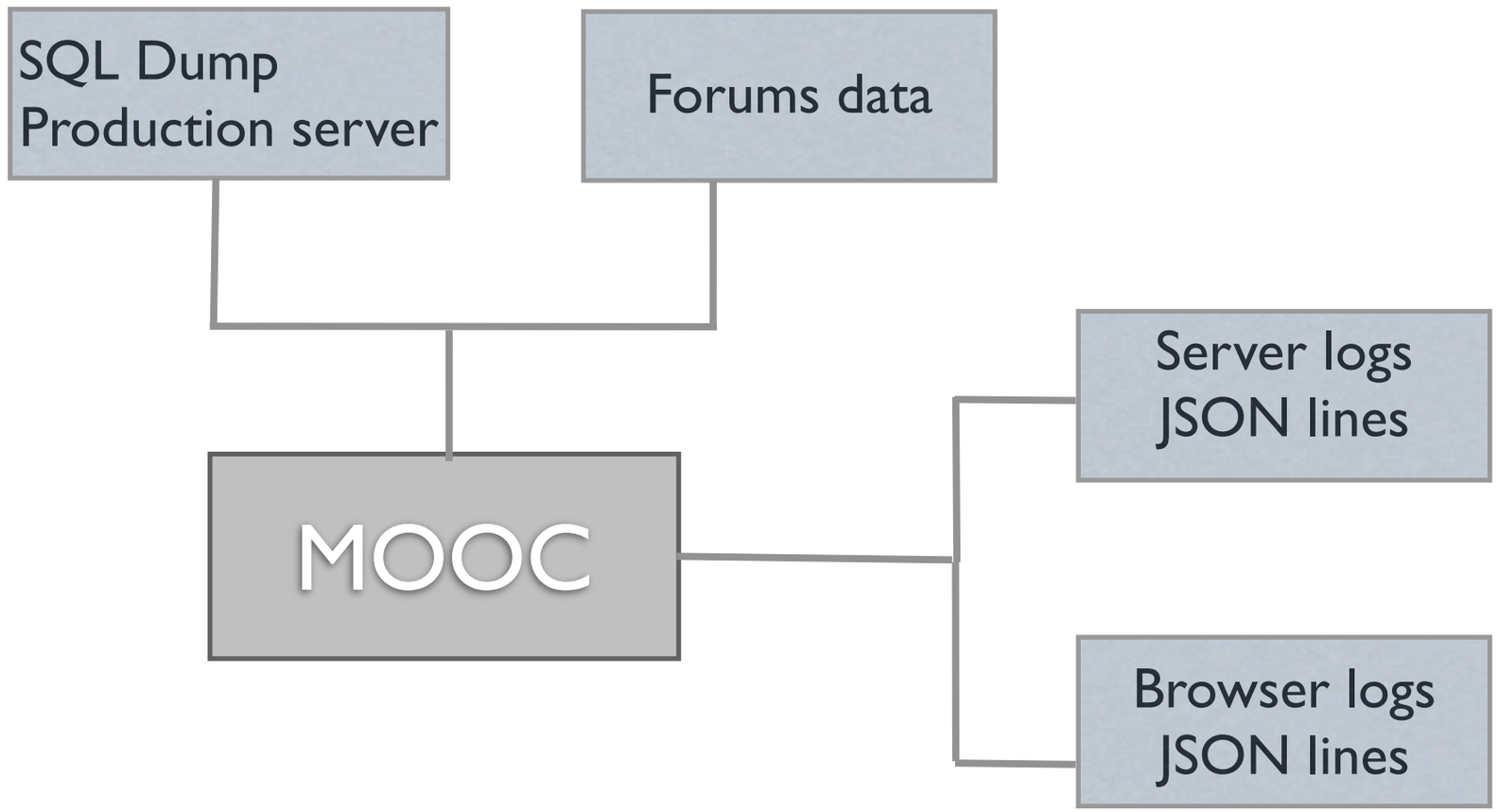

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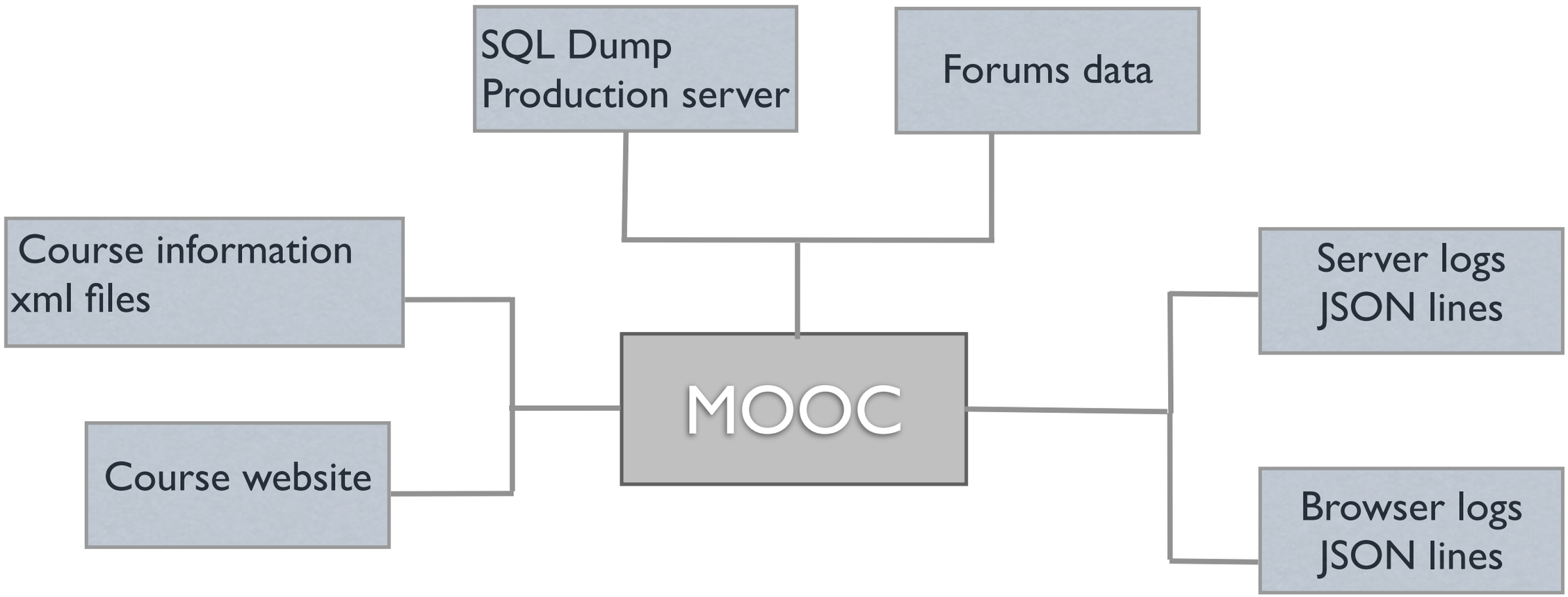

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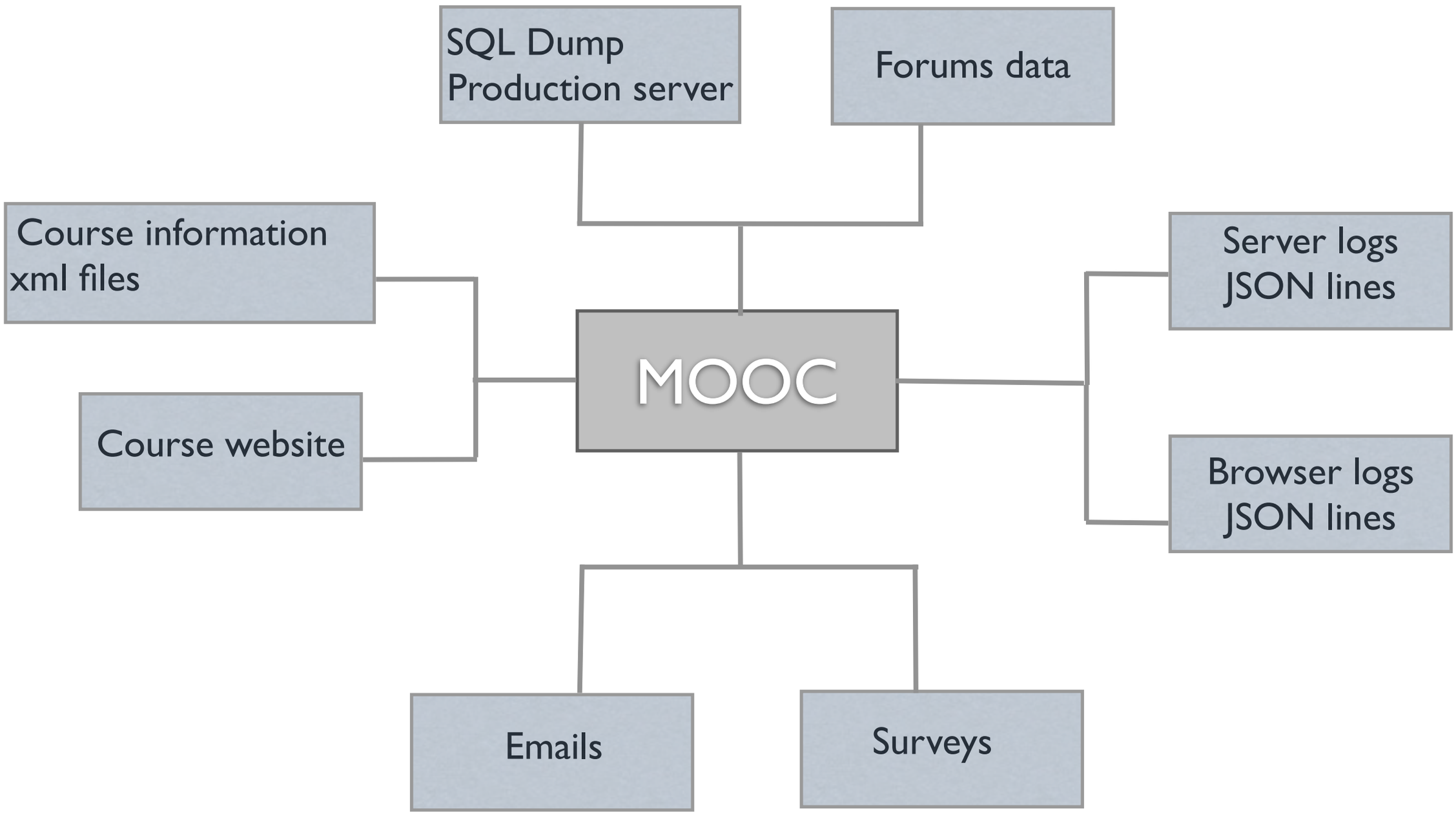
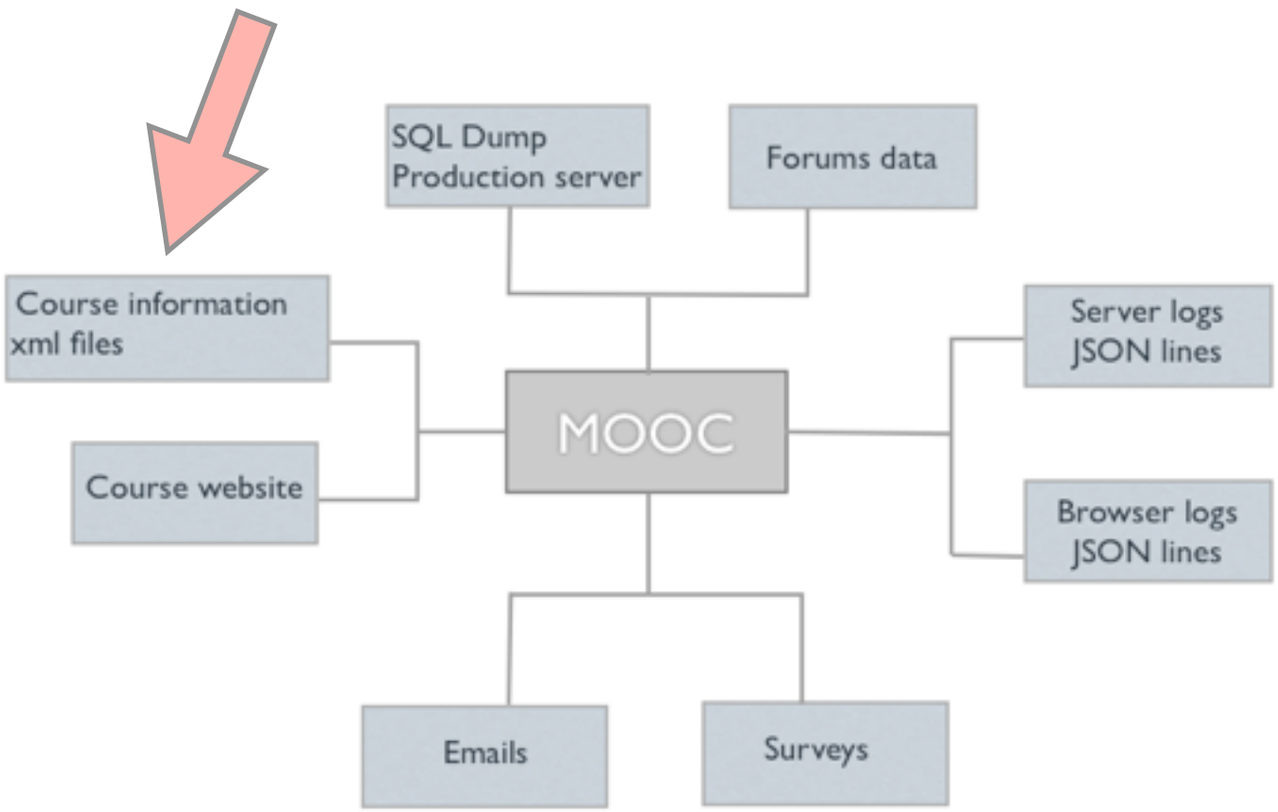


Example Research Question

RQ1: How does amount of time spent on the video correlate to performance on the homework?



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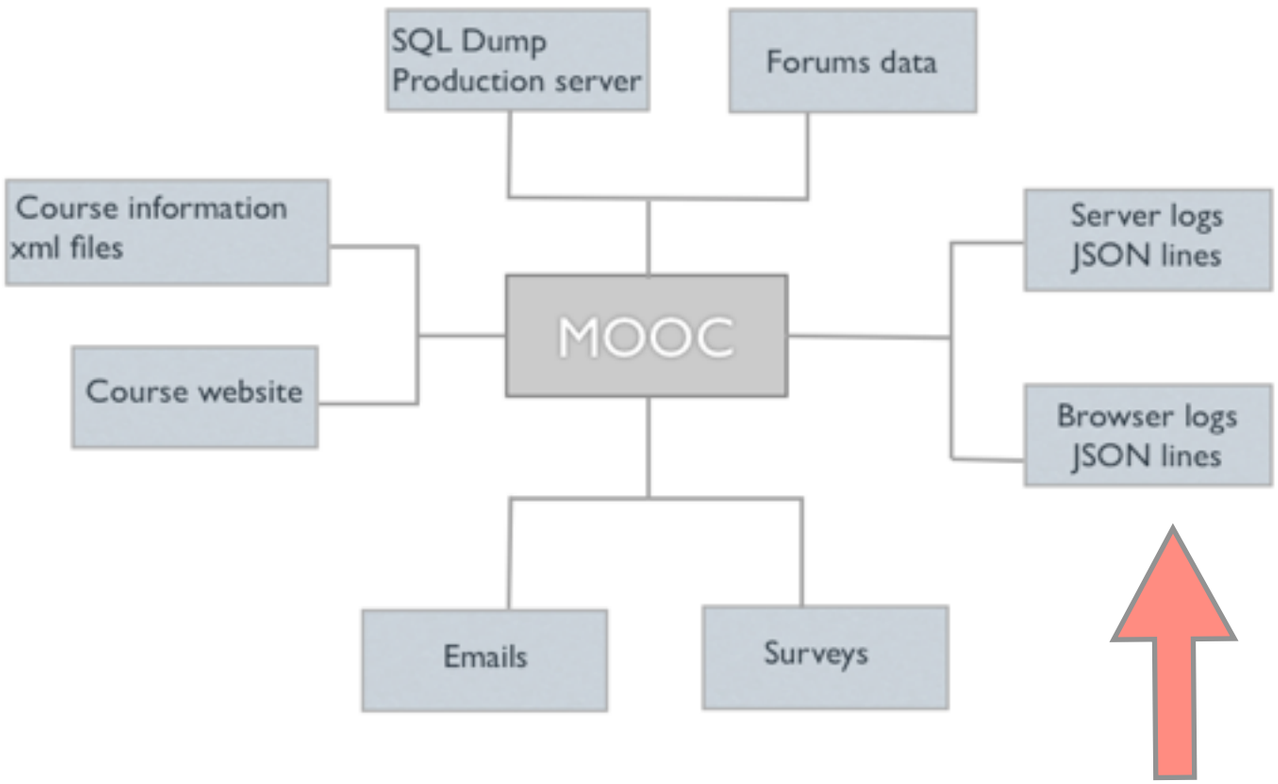

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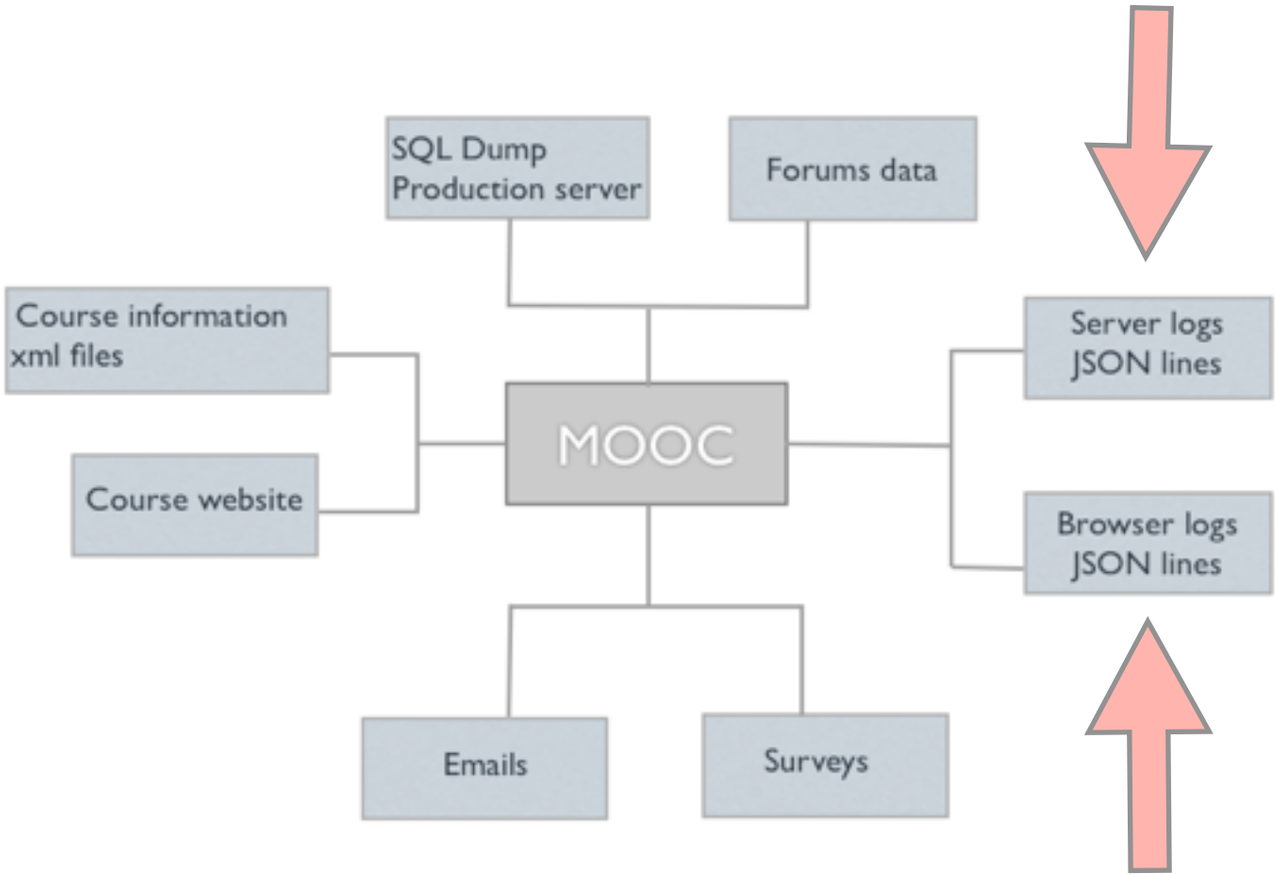

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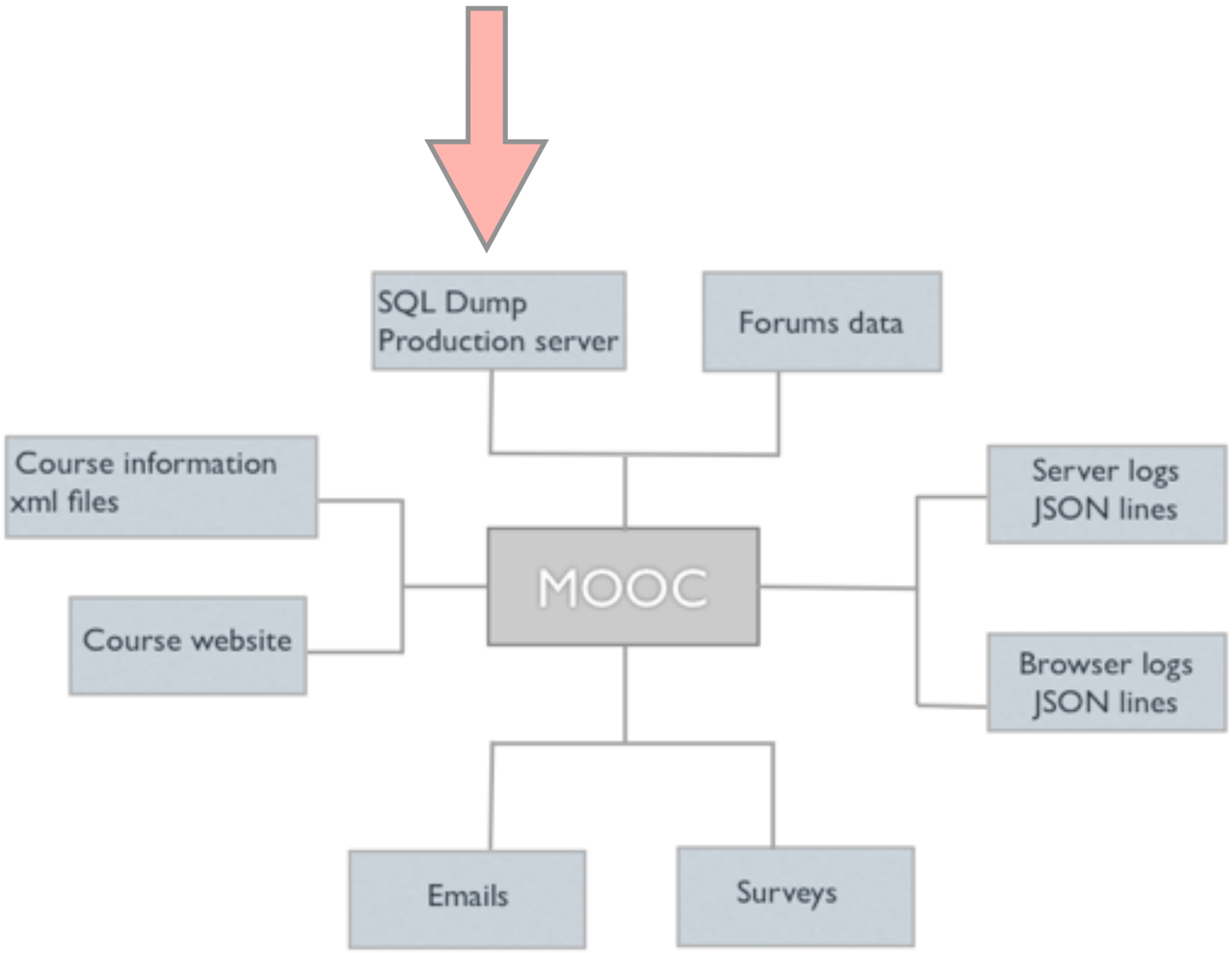

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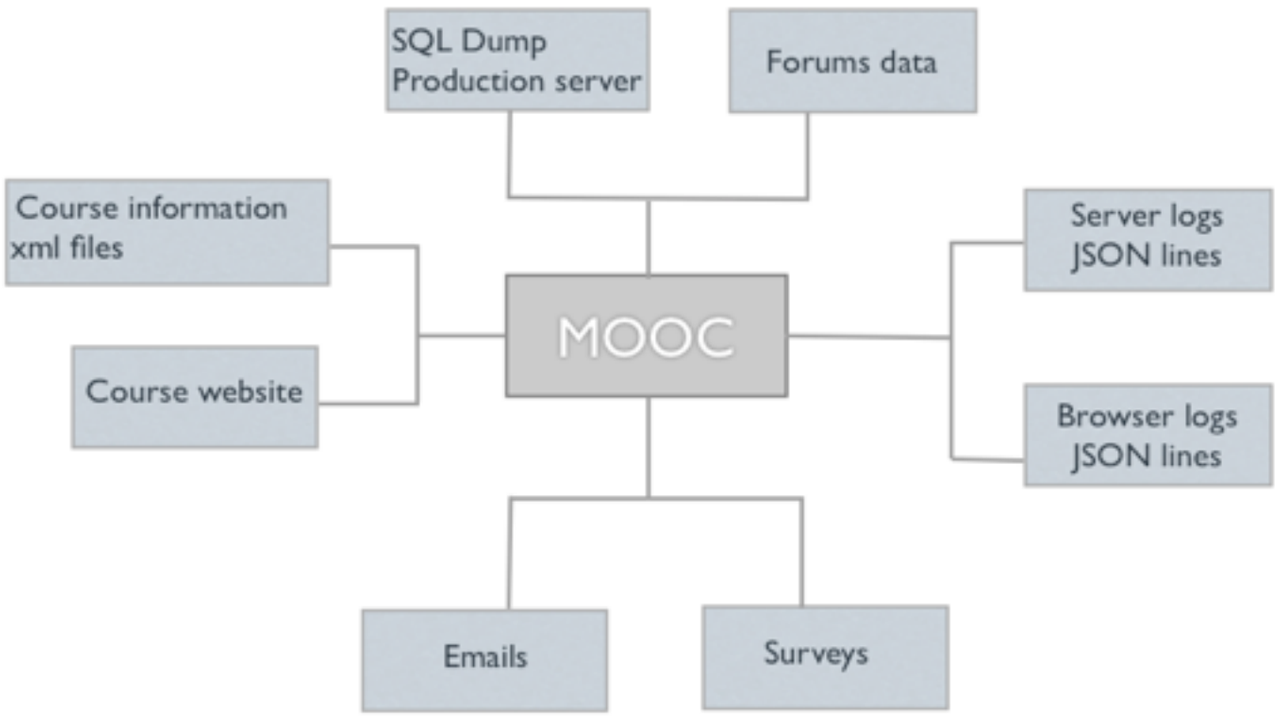

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Run corr function in MATLAB

Where are the bottlenecks?

A typical process

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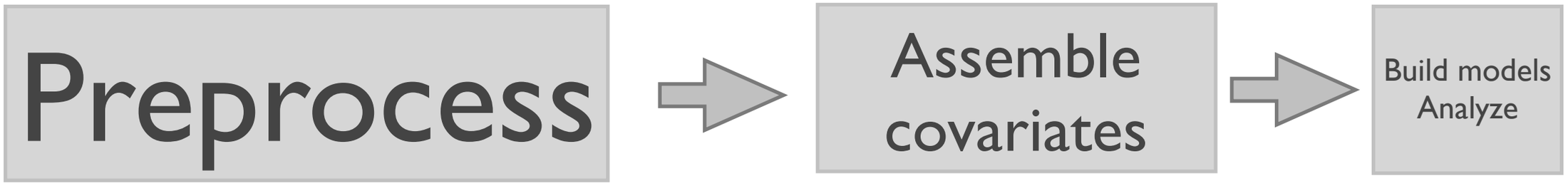
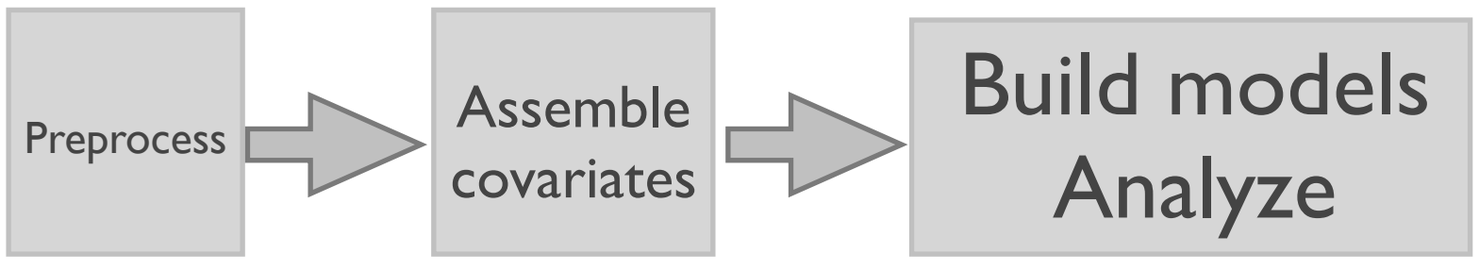
What is now ?

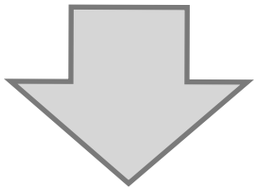


What we desire ?



sizes represent the time spent in doing the activity

How about we organize the data using a concise schema that we will always adhere to ?



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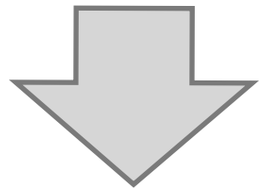

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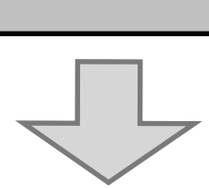
Challenge: Generalizable, loss-less

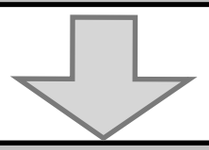
Steps to Data science @ scale

Step 1: Develop a generalizable, loss-less schema for the data

Step 2: Define and design APIs to extract multiple views of data



Step 3: Design user friendly APIs



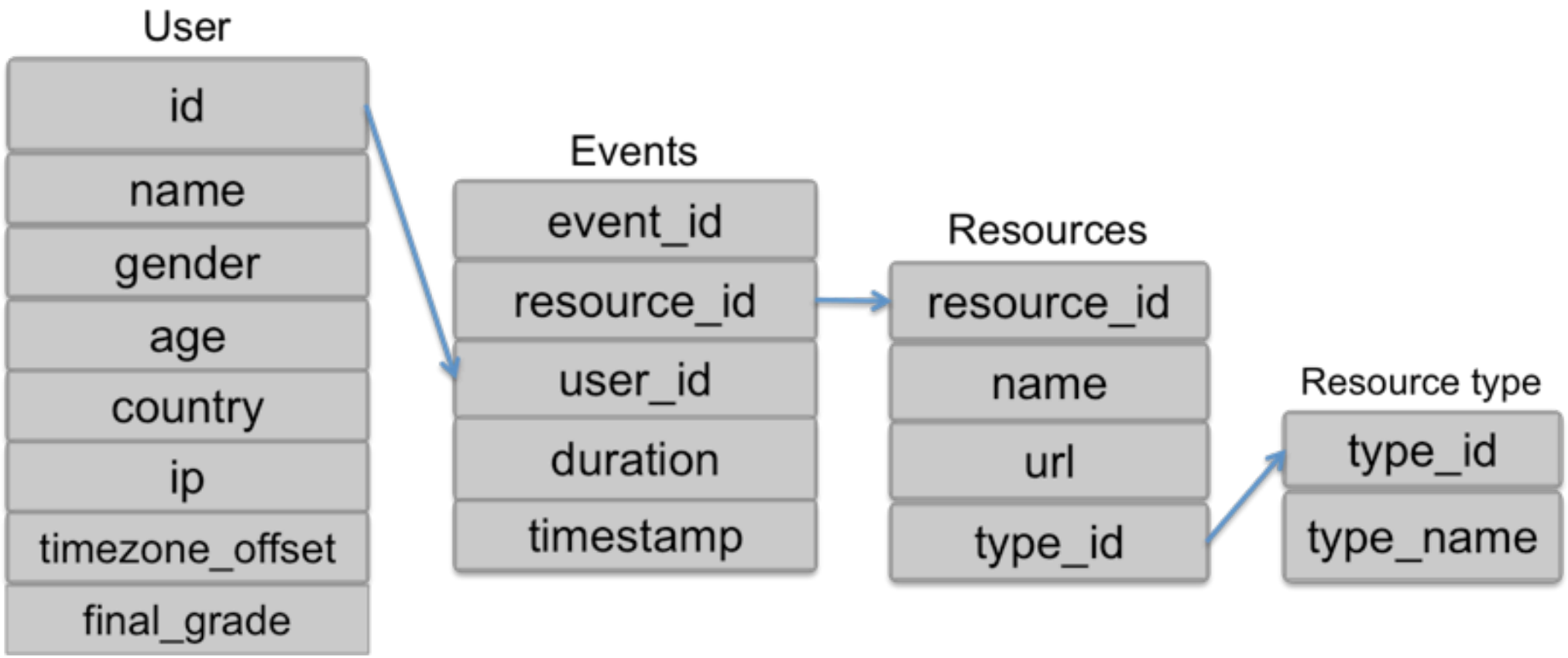
Step 4: Design a platform where users can contribute and share the scripts

Step 1: Develop a generalizable, loss-less schema

- Students interact with the system in the following ways
  - Observe
  - Submit
  - Collaborate
  - Give feedback

Step 1: Develop a generalizable, loss-less schema

The observing mode



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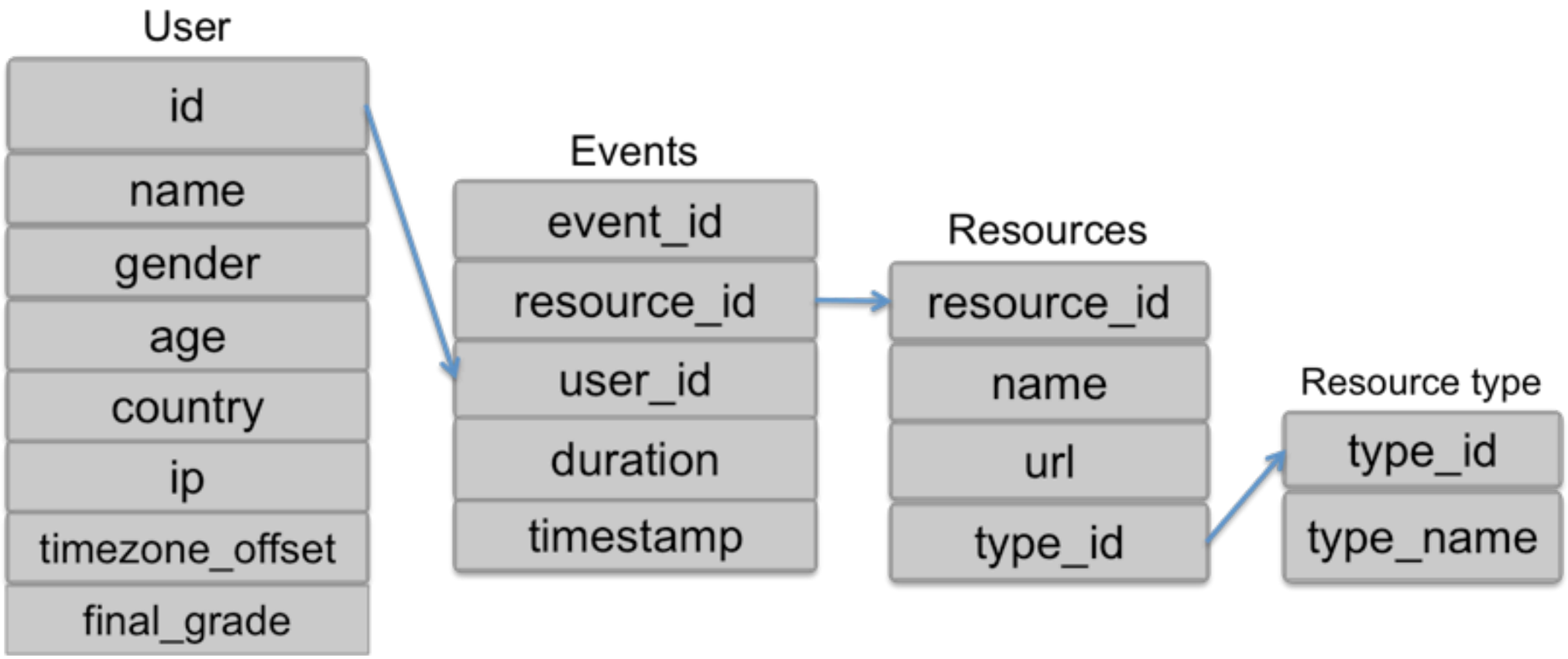

Is this generalizable?

Step 1: Develop a generalizable, loss-less schema

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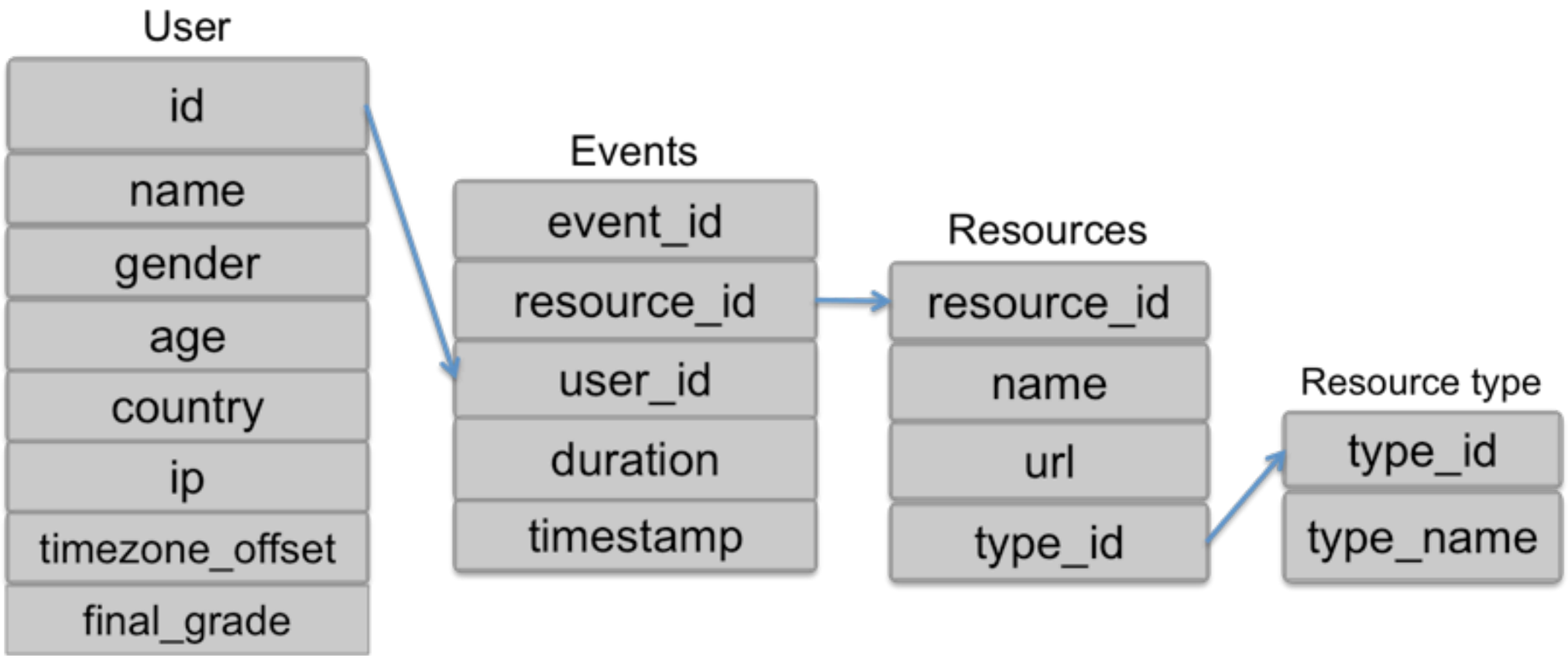

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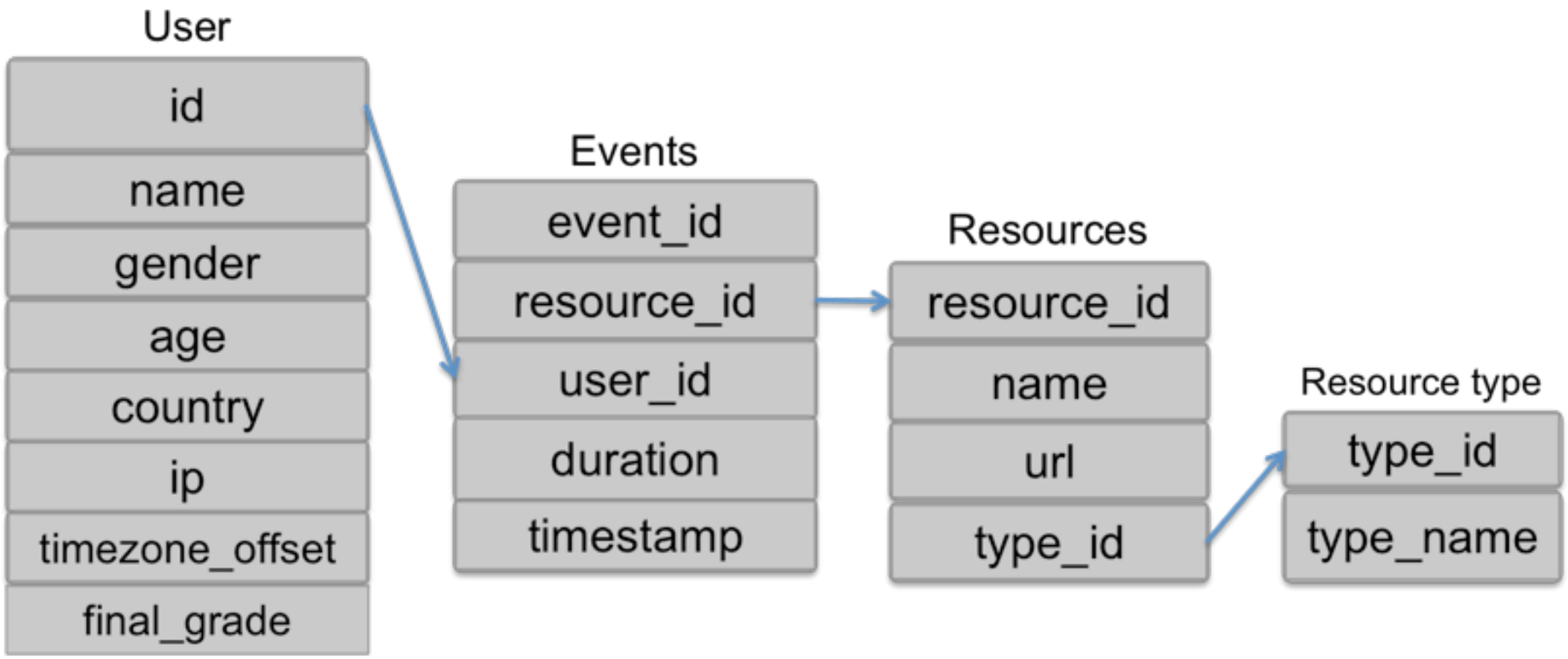

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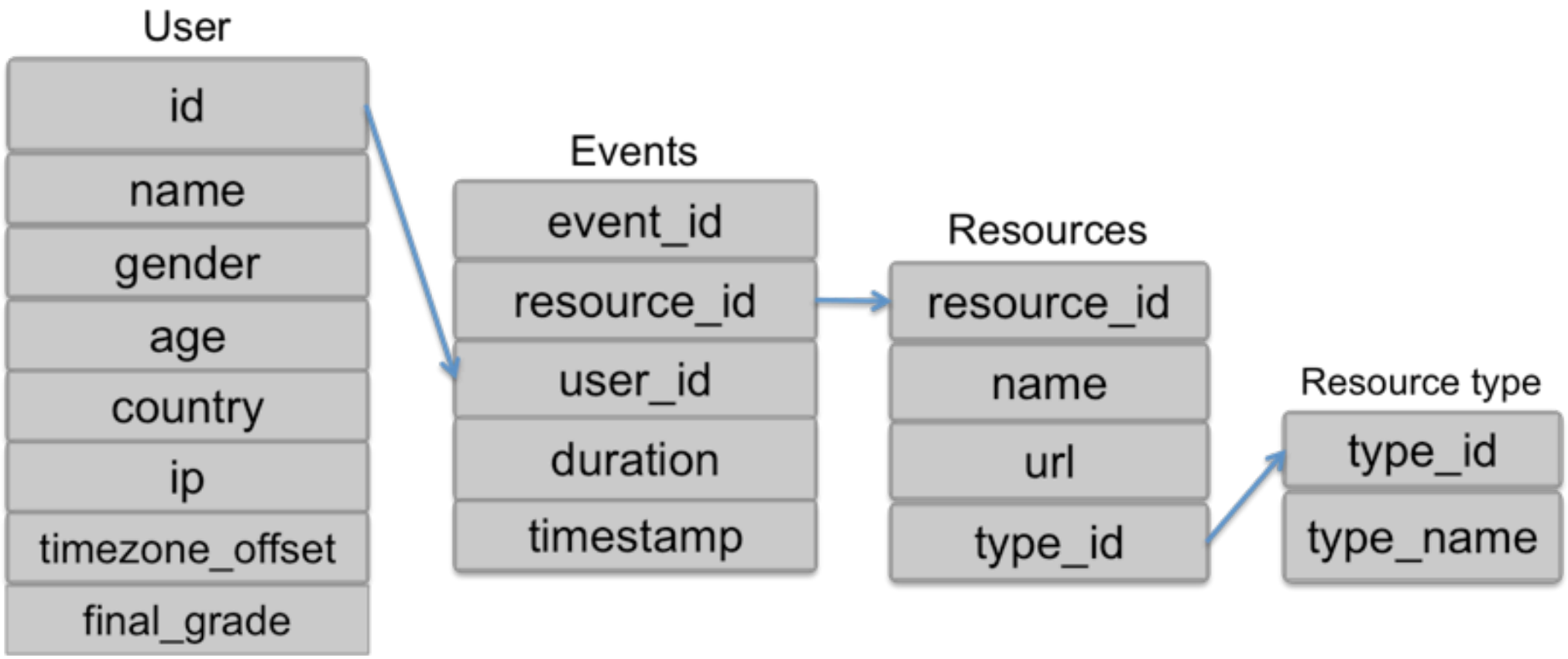

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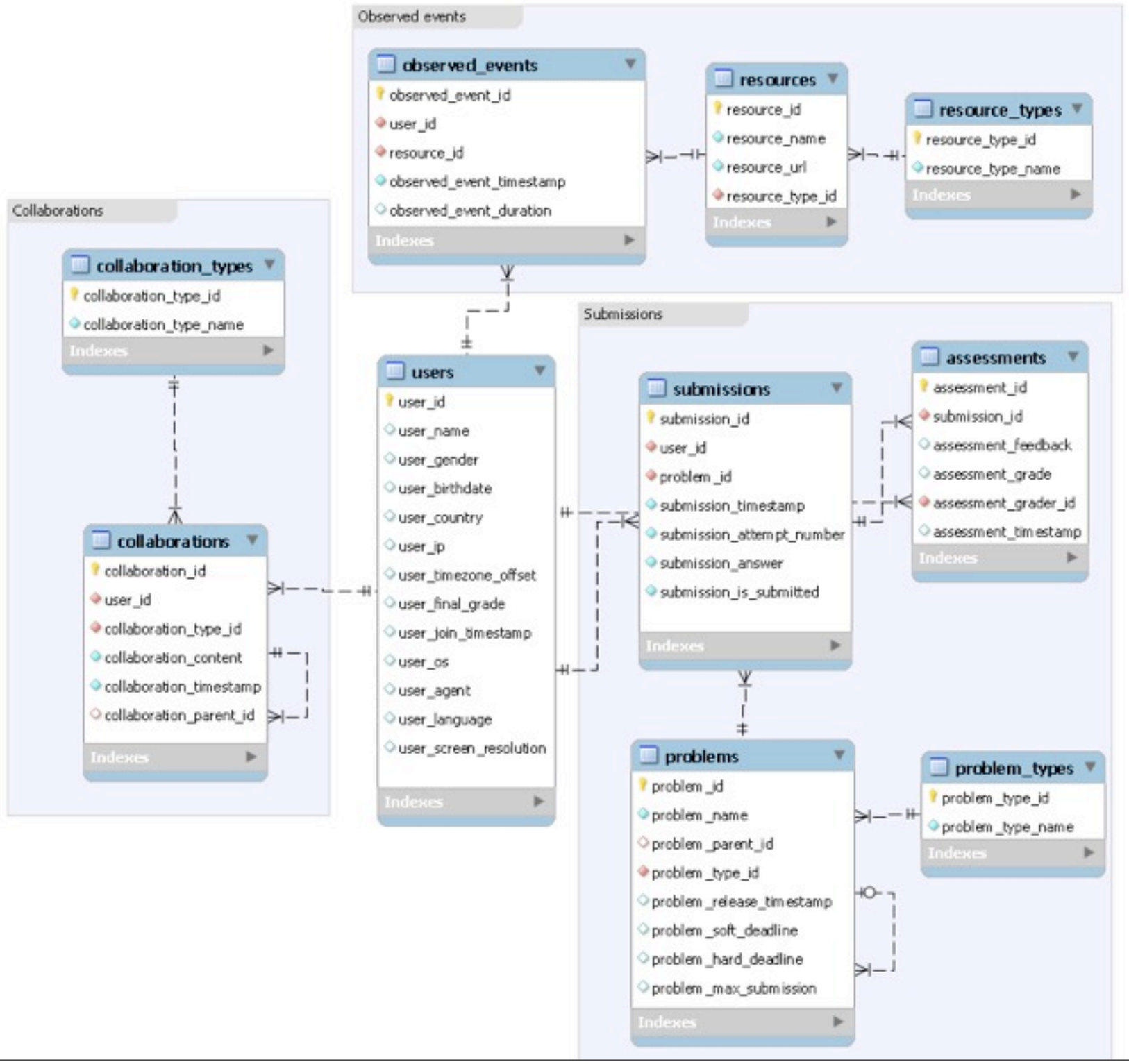
Step 1: Develop a generalizable, loss-less schema

MOOCdb



Step 2: Define and design APIs to extract multiple views of data

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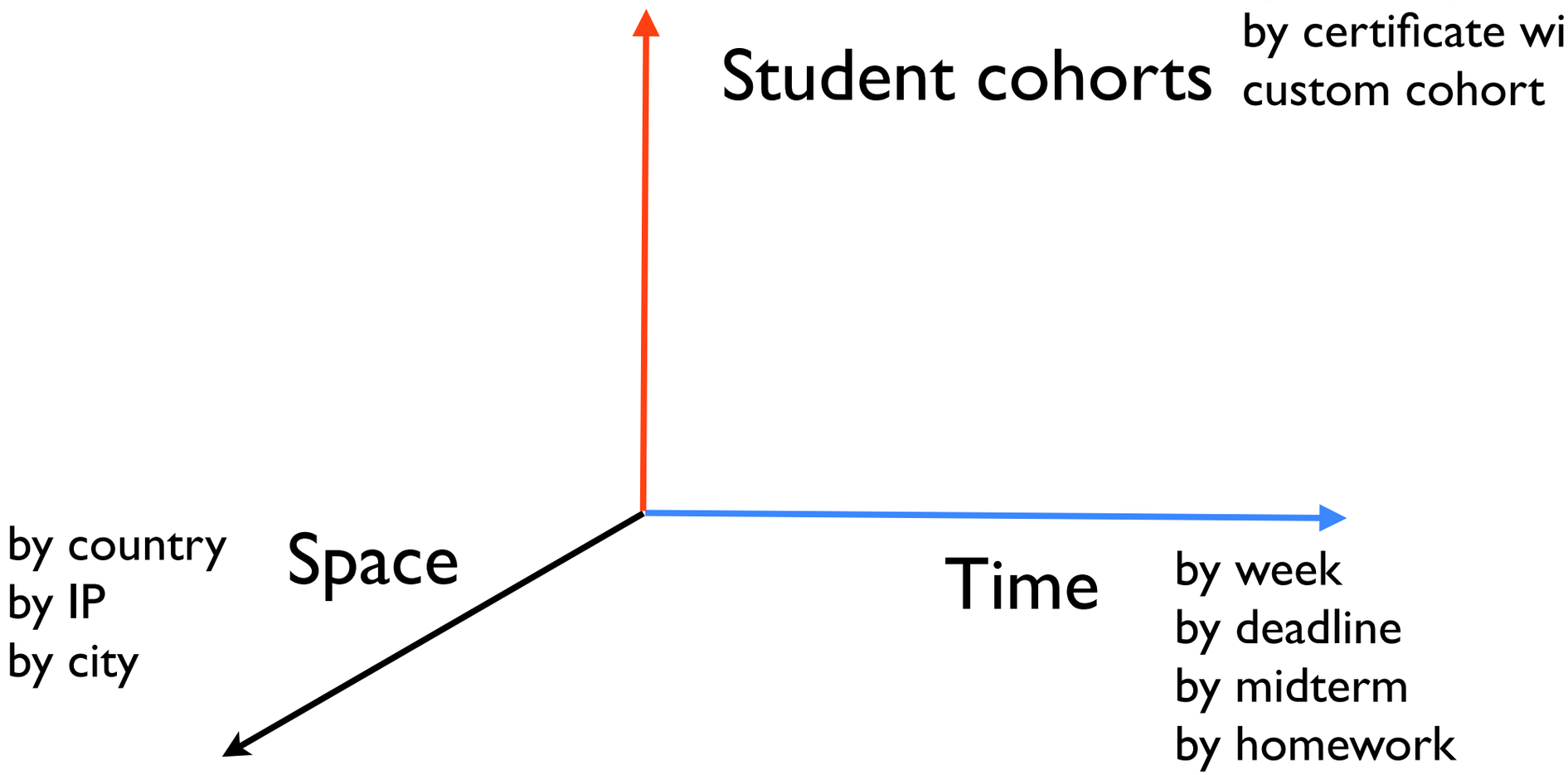

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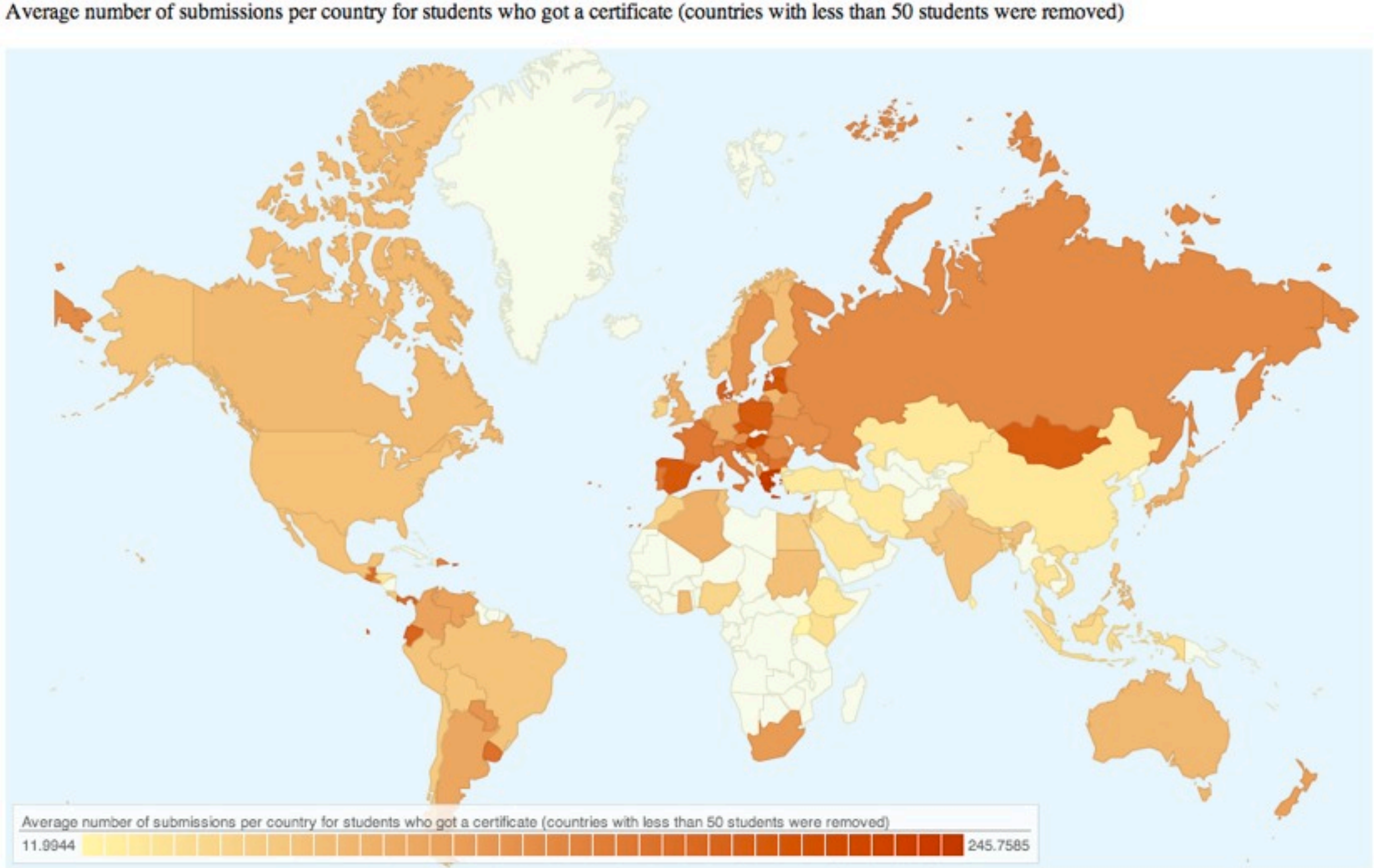

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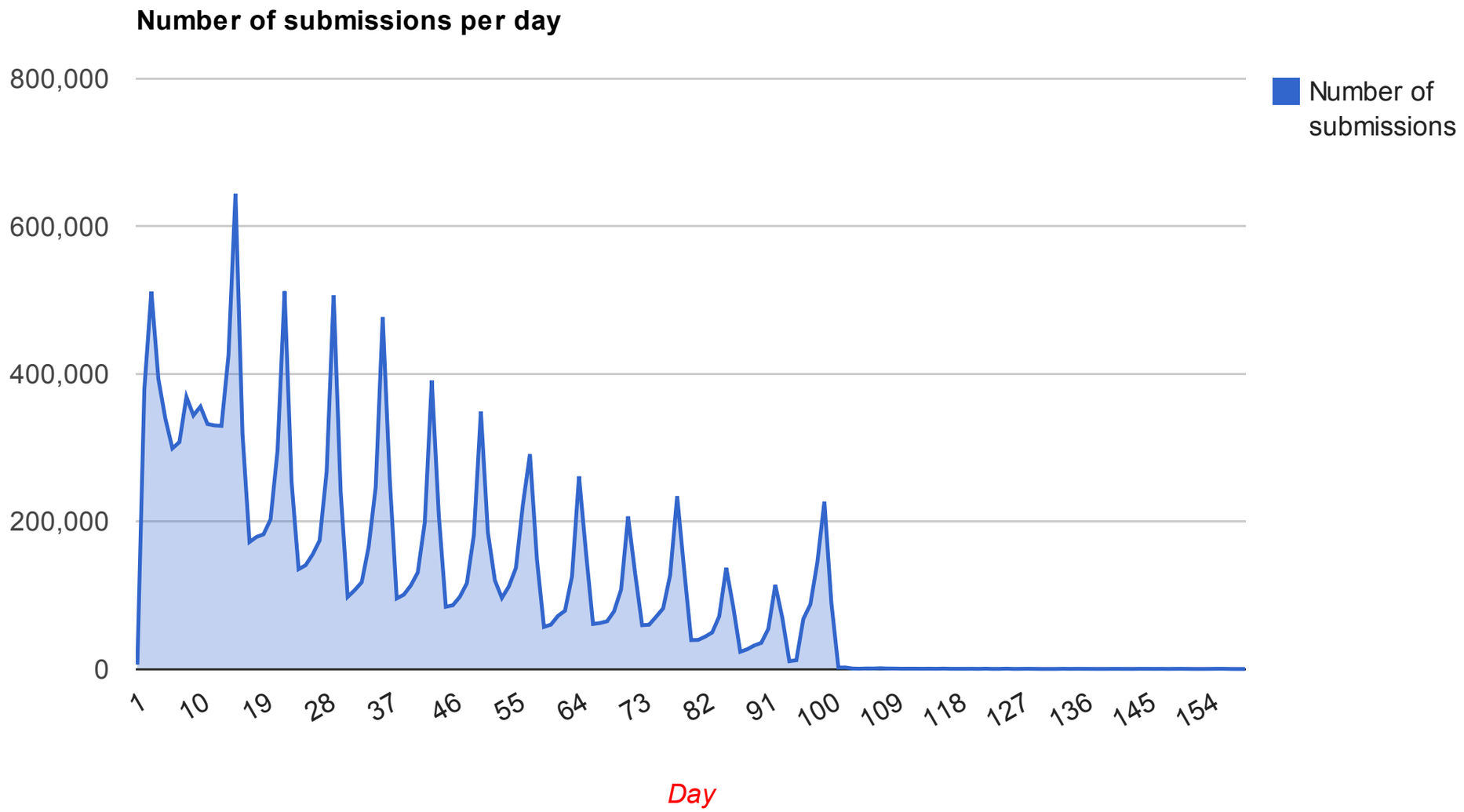


Step 3: Design user friendly APIs

MOOCdb - Access

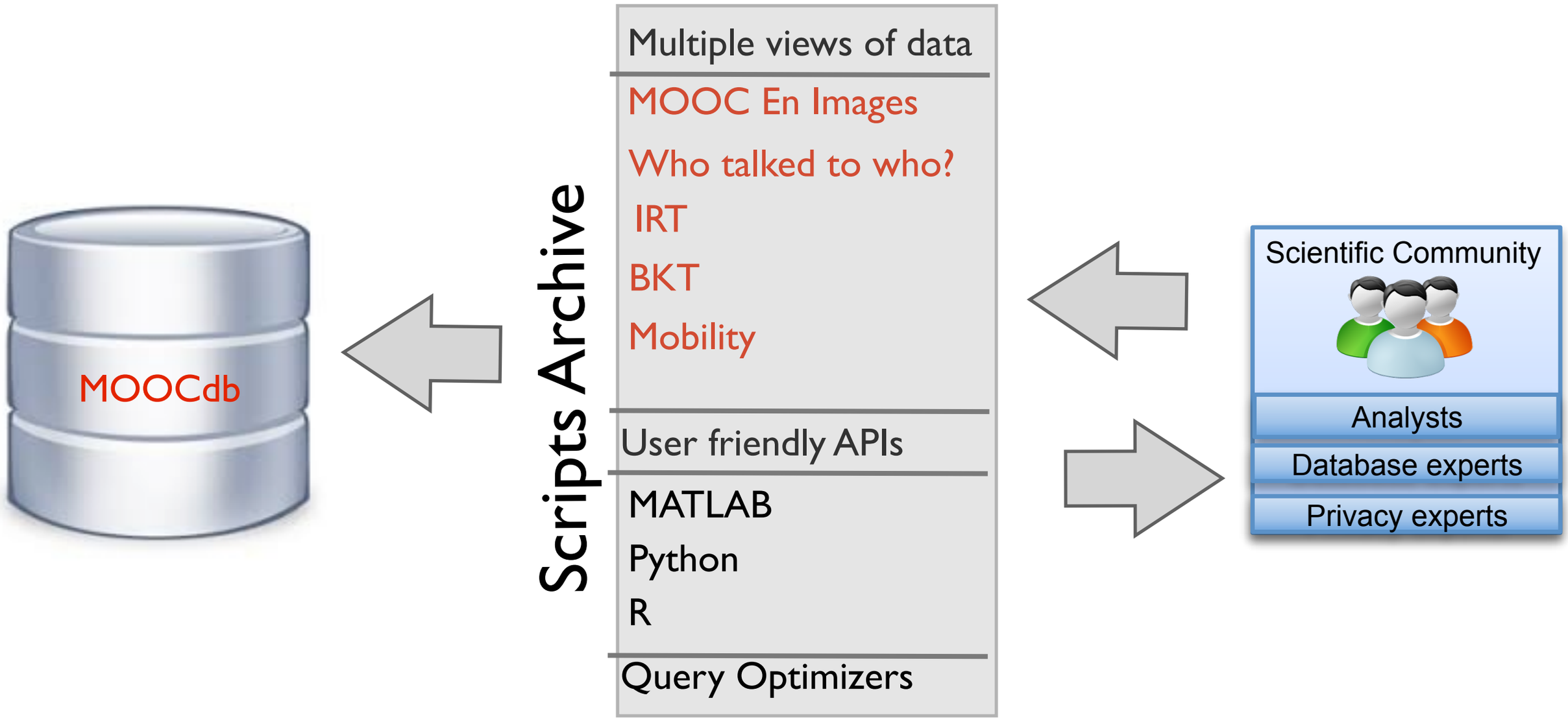
MATLAB

```
%% Running queries
% http://www.mathworks.com/help/database/run-sql-query.html

sql = [' SELECT observed_events.observed_event_duration ' ...
    ' FROM moocdb.observed_events AS observed_events ' ...
    ' WHERE observed_events.observed_event_duration < 200' ...
    ' LIMIT 100000; '];

cursor = exec(connection,sql);
a = fetch(cursor);
data = cell2mat(a.Data);

boxplot(data)
title('Distribution of the duration of observed events')
ylabel('Duration (in seconds)')
print('-dpng','-r300', ['observed_events_duration_boxplot'])
saveas(figure(1), 'observed_events_duration_boxplot', 'fig')

plot(sort(data))
title('Distribution of the duration of observed events')
ylabel('Duration (in seconds)')
print('-dpng','-r300', ['observed_events_duration_plot'])
saveas(figure(1), 'observed_events_duration_plot', 'fig')
```

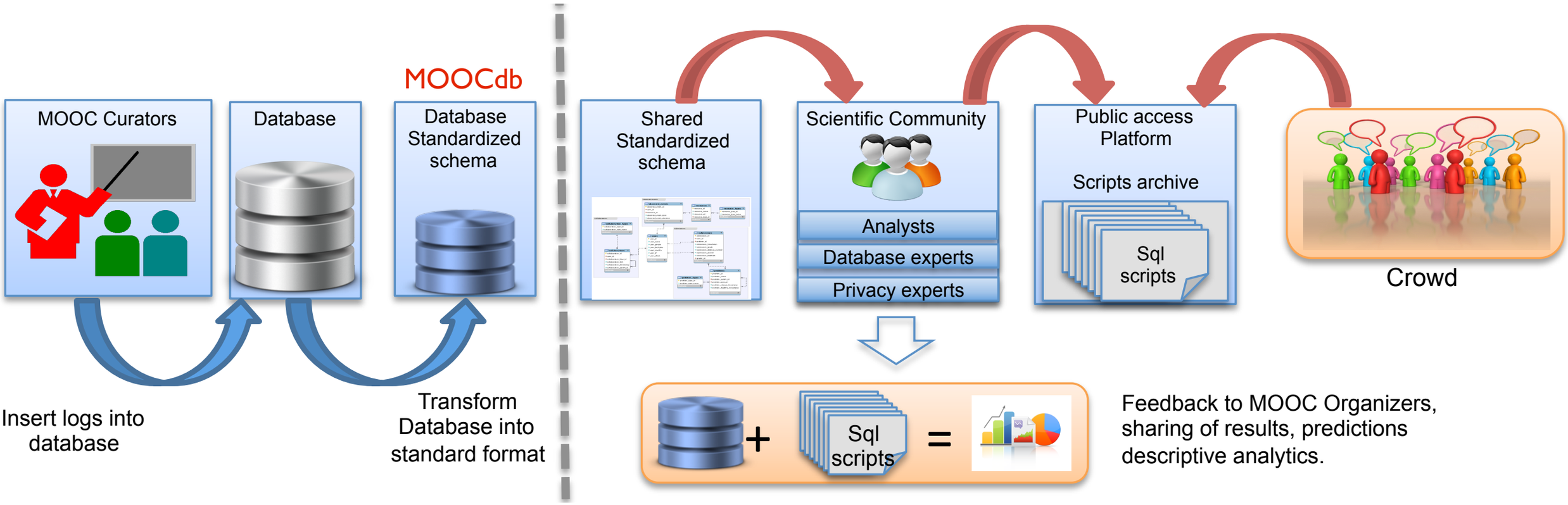
Python

```
import google_charts_wrapper

def main():
    '''
    This function plots the number of new registered students every day from 2012-02-13
    '''

    sql = '''
    -- Takes 1 second to execute
    SELECT DATEDIFF(users.user_joined_timestamp, '2012-02-13 00:00:01')  AS `Day`,
     COUNT(*) AS `Number of new registered students`
     FROM moocdb.users AS users
     GROUP BY `Day`
     HAVING `Day` >= 0
    ORDER BY `Day` ASC
    ;
    '''

    options = google_charts_wrapper.options()
    options.set_data(google_charts_wrapper.get_data(sql))
    options.set_chart_type("area_chart")
    options.set_chart_title("New registered students every day from February 13, 2012")
    options.set_height(500)
    options.set_width(900)
    options.set_page_title("New registered students every day from February 13, 2012")
    options.set_h_axis("{title: 'Day #' ,  titleTextStyle: {color: 'blue'}}")
    options.set_v_axis("{title: 'New registered students' ,  titleTextStyle: {color: 'blue'}}")
    options.set_output_file("./output/users_join_date.html")
    print options.get_data()
    google_charts_wrapper.generate_html(options)

if __name__ == "__main__":
    main()
```

Step 4: Design a platform where community can share scripts



Leading to standardization



Benefits of standardization

- Reduction in time to analyze (TTA)
- Publicly available scripts to create data views
- Unified representation to DB/Privacy experts
- Crowd sourcing of feature engineering
- Crowd sourcing of data analytics
- Elimination of entry barriers

Thank you!

Look for MOOC En Images, updates on MOOCdb and open release of all the tools.