

When and Where? Time-spatial analytical visualization of events

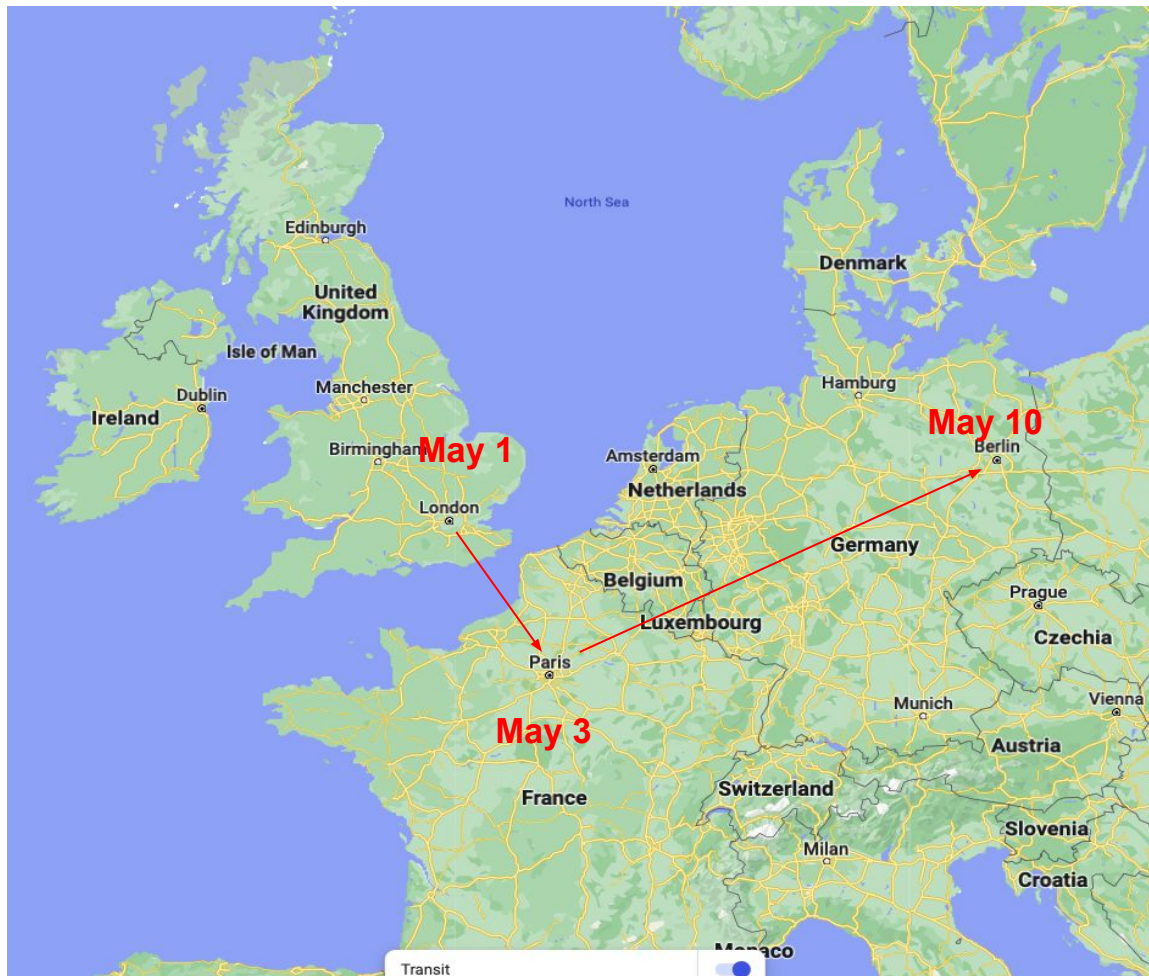
Ruoyu Zhang
Yanyu Chen
Yifan Zhou

General Idea

- When describing an event, time and space information are always deeply coupled.
 - What happened? When? Where?
- However, this information is always buried in texts and there is little tool to help visualize it.
 - Wikipedia pages
 - Tweets
 - Travel logs
 - Biography/history

Example

“On May 1, I visited London. Then I went to Paris by plane on May 3. I took a train to Berlin and I arrived at May 10.”



Our framework and plugins

- **What does the framework do?**

- Request texts and other information to be processed from data plugins
- Transformed texts into key-value pairs: (example keys: time, space, event) with Named Entity Recognition (NER).
- Send these pairs to the visualization plugins to display

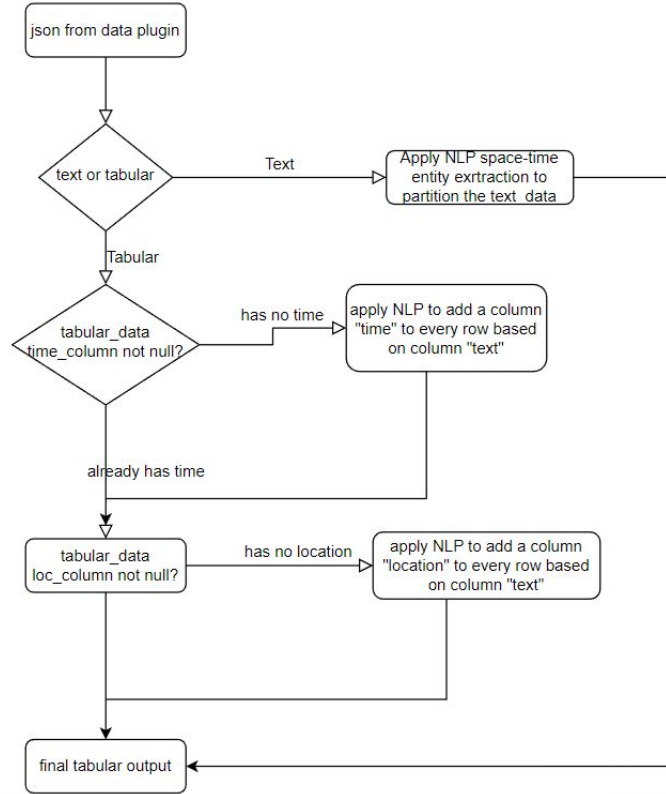
- **What does plugins do?**

- Data plugins are responsible for extracting texts from data sources based on user-configurable requirements.
- Visualization plugins would take the JSON file sent by the framework and visualize the interactions between time, space and event.

Example Output of the Data Plugin

```
/**
 * Example structure for the stored data to be processed by framework
 */
{
  "Text_or_tabular": String (whether the data is recorded in text or tabular format),
  "has_time": boolean (whether the tabular data has a time column),
  "has_location": boolean (whether the tabular data has a time column),
  "Text_data": String (data in text format),
  "Tabluar_data": [
    {
      "time": String,
      "location": String,
      "text": String},
    {
      "time": String,
      "location": String,
      "text": String},
    ...
  ]
}
```

Inside the Framework



Examples of plugins

- **Data plugins**

- **Wikipedia plugins** take in a keyword provided by users. The plugin would use Wikipedia's API to extract texts from the search result.
- **Twitter plugin** takes in a keyword provided by users. The plugin would use Twitter's API to extract a complete response from Twitter.

- Visualization plugins

- **When-and-where plugin** indicates the location of all events across the timeline. You can move along the timeline to see what's happening and where it happens.
- **Heatmap plugin** indicates the frequency of events happening across the timeline. It's similar to Github's famous heatmap for commits.



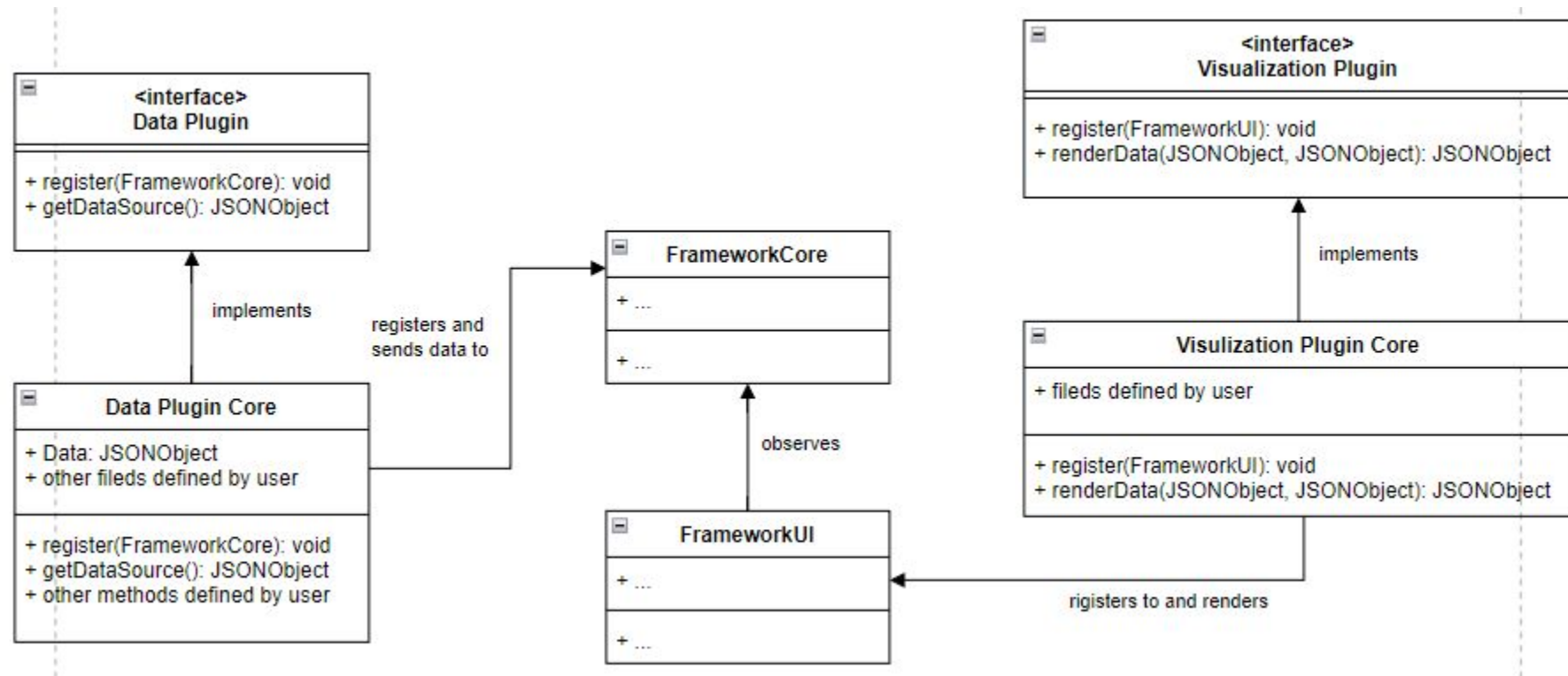
Possible Data Plugin Interface

```
public interface DataPlugin {  
  
    /**  
     * Called (only once) when the plug-in is first registered with the  
     * framework, giving the plug-in a chance to perform any initial set-up  
     * before the game has begun (if necessary).  
     */  
    public void register(Framework framework);  
  
    /**  
     * Every class that implements this interface should have a field of  
     * JSONObject to store the data to be processed by framework  
     * This method will return that field of JSONObject to the framework  
     */  
    public JSONObject getData();  
}
```


Possible Visualization Plugin Interface

```
public interface VisualizationPlugin {  
  
    /**  
     * Called (only once) when the plug-in is first registered with the  
     * framework, giving the plug-in a chance to perform any initial set-up  
     * before the game has begun (if necessary).  
     */  
    void register(Framework UI framework);  
  
    /**  
     * Use the data from passed from the framework,  
     * under a configured setting in JSON format,  
     * renders the data in the front-end  
     */  
    HTML_Element renderData(JSONObject data, JSONObject config);  
}
```

UML Model



Generality vs specificity

- **Generality**
 - The framework can restructure any data: text or tabular
 - When the dataset does not have original time/space data, we use the Entity Recognition API developed by Stanford's CoreNLP enables humongous potential generality
 - Use cases include presenting a biography, planning a trip, and tracking a route with a map and timeline
- **Specificity**
 - not meaningful when the input text has no clear partitions in terms of time or space(poems)
 - Aks plugin developers to validate whether data sources inherently contain data or space entities that can be extracted.

Thanks!