Web APIs:
1. Stripe API: https://stripe.com/docs/api/
2. GitHub API: https://docs.github.com/en/rest
5. Queue@Illinois API https://github.com/illinois/queue/blob/master/doc/API.md

Common Features in Best in Class API design:
1. 
2. 
3. 
4. 
5. 

Data Stores -- (SQL, NoSQL/Mongo/Redis):
- Optimized for data storage and lookup.
- Focus on queries for data:
  - SELECT * FROM table WHERE date="2021-11-26";
  - find_one( {date: {$eq: "2021-11-26"}} )
  - ...
- Developer is responsible for processing the data.

Problems?

Big Data Processing
- Optimized for data processing on large data sets.
- Queries involve functions that perform logic as part of processing the data.
- Key Technology: ________________.

MapReduce
- Developed as a research project out of Google.
- OSDI’04: “MapReduce: Simplified Data Processing on Large Clusters”
- **Big Idea:** Create a framework for processing data based on functions that can be “automatically parallelized”.
  - Allows many nodes to contribute to processing the data without human design/programming.

MapReduce: Map Functions

- Input:
- Output:

Reduce Function:

- Input:
- Output:

Example #1: Word Count

<table>
<thead>
<tr>
<th>The</th>
<th>quick</th>
<th>brown</th>
<th>fox</th>
<th>jumps</th>
<th>over</th>
<th>the</th>
<th>lazy</th>
<th>dog</th>
</tr>
</thead>
<tbody>
<tr>
<td>[0]</td>
<td>[1]</td>
<td>[2]</td>
<td>[3]</td>
<td>[4]</td>
<td>[5]</td>
<td>[6]</td>
<td>[7]</td>
<td>[8]</td>
</tr>
</tbody>
</table>

Map:

Reduce:

Example #2: Mutual Friends

Through asking about your friends about their friends, you have identified who are friends of whom (→ means “is friends with”):

- A → B, C
- B → A, C, D
- C → A, B, D
- D → B, C

You want to identify all mutual friends to any set of two people. For example: {A, B} → C, D.

Map: