ECS 162
WEB PROGRAMMING

- too short!

Question 7

```
1
2  // onclick for button
3  function buttonAction {
4          let cameraData = none;
5          console.log("Beginning download");
6          beginCameraDownload(cameraData, function ( ) {
7                  console.log("In anonymous callback function");
8                  }
9          );
10  }
```

- Where do we display the data returned from the camera?

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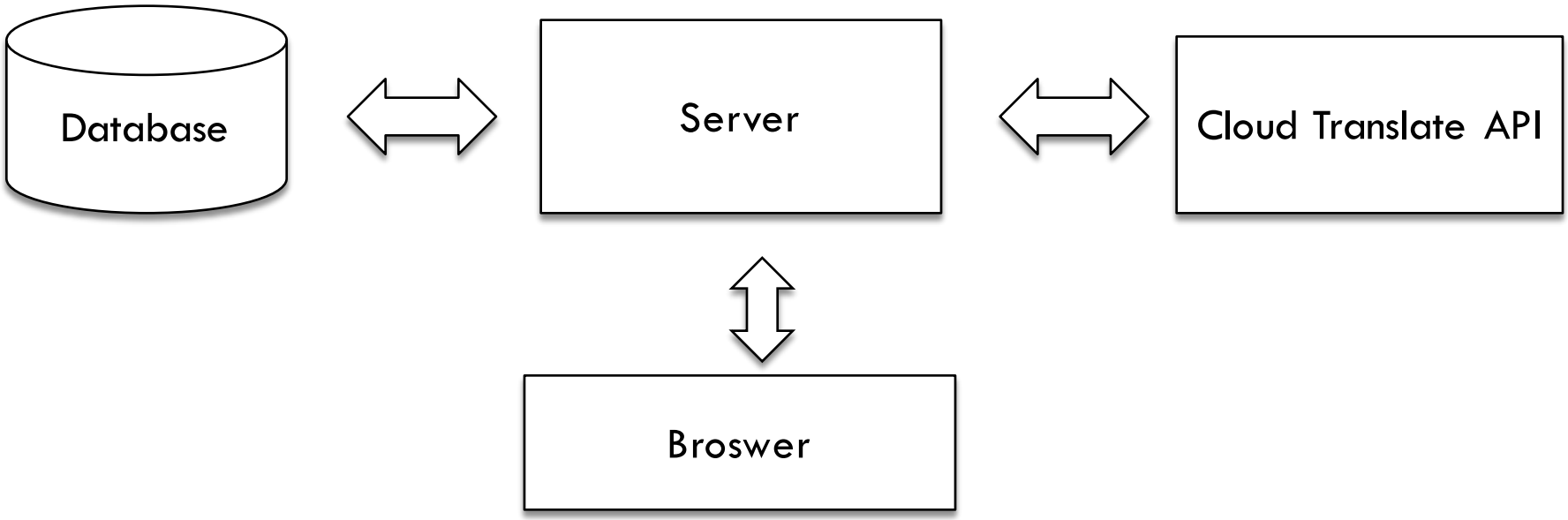
```

- Where do we display the data returned from the camera?

After line 6. You don't have the data until the anonymous callback function runs.

System design

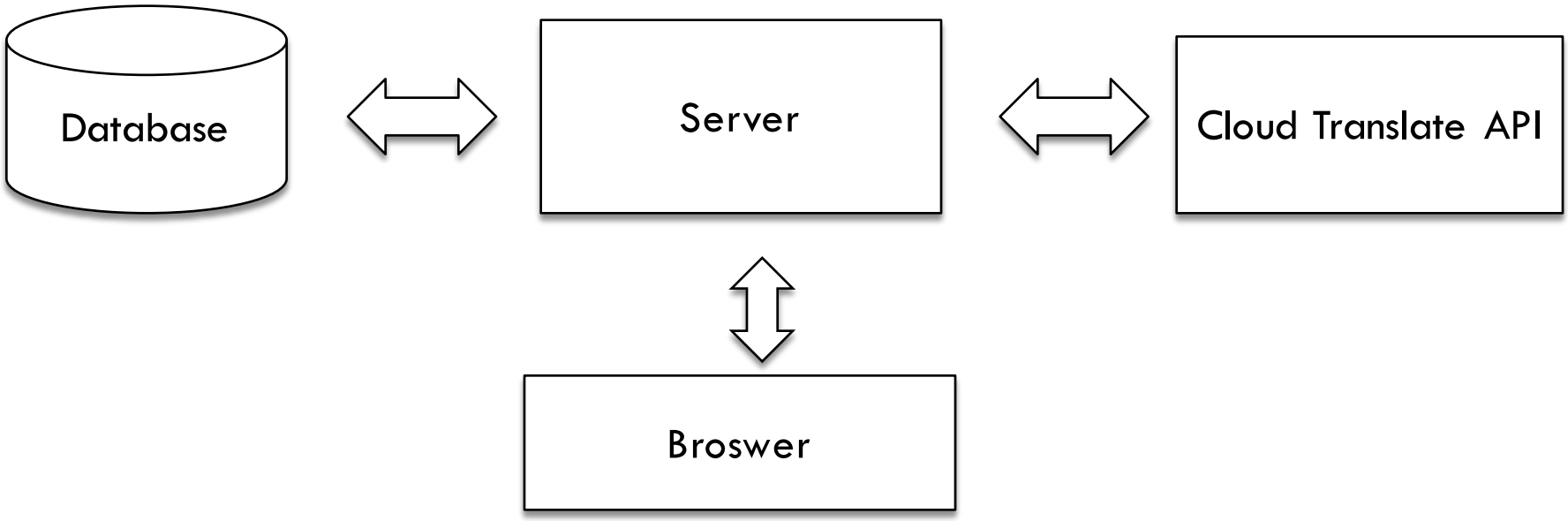


- Browser only communicates with Server (via AJAX)
- Server communicates with Database and API.

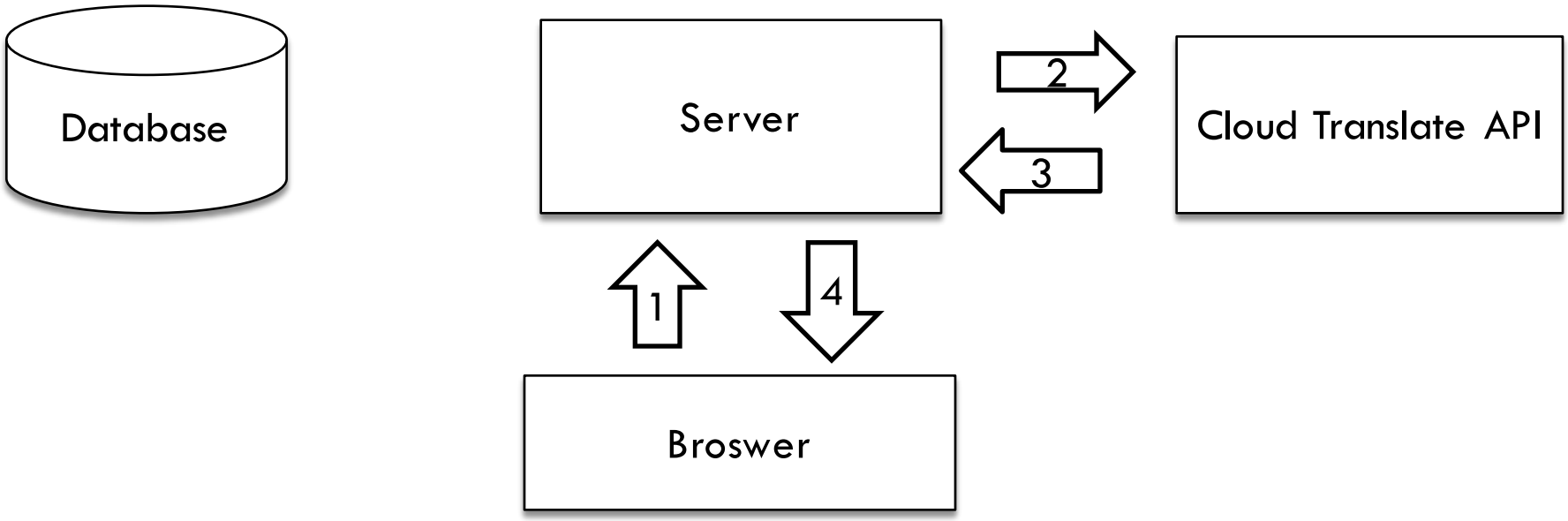
Translation

User types on left, hits return. Expects to see translation. What happens next?

System design

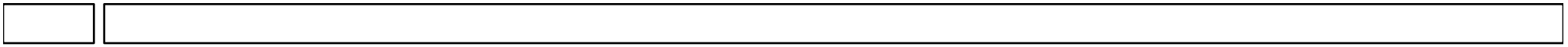


Doing a translation



- Browser sends AJAX request to server with English text.
- Server server sends HTTP request with English text to CT API, waits for response.
- When API response comes back, Server sends response to Browser.

See database cartoon



Databases

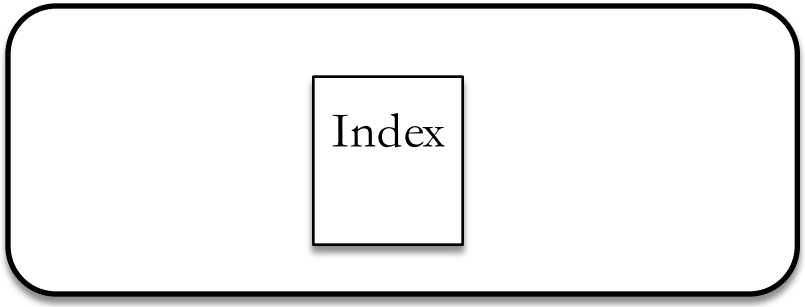
- A database is
  - A file, or collection of files, storing data, stored on some server's disks
  - Could be app's server (will be, for us), or could be another server on the internet
  - Software for interfacing to that data
-

Databases

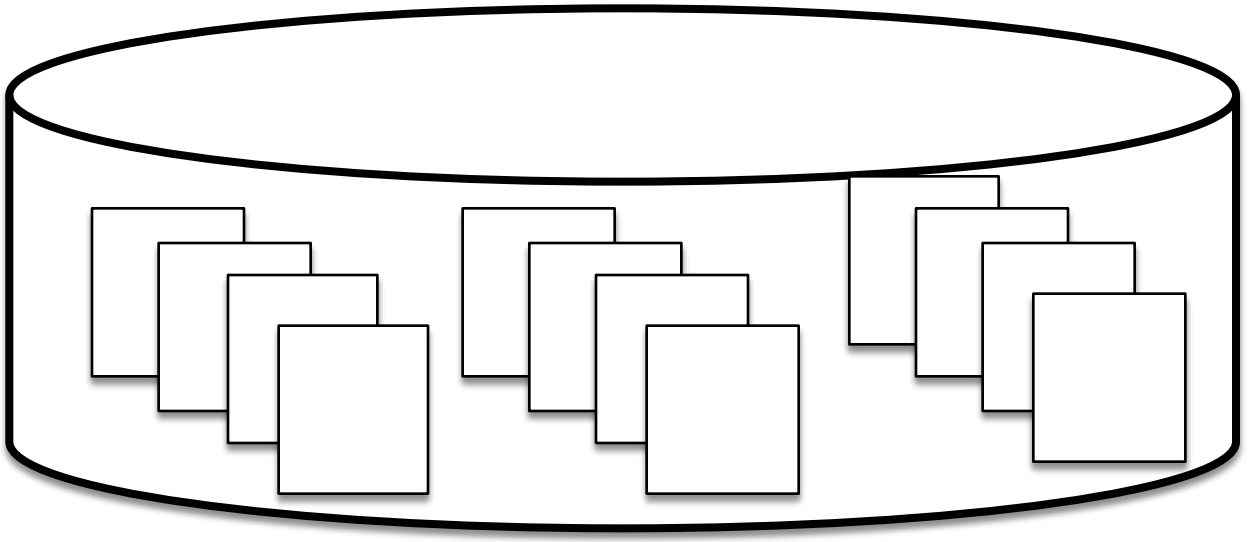
- Normal files on disks and (when not in a database) are read from beginning to end
- Say we're looking for something near the end, or in the middle, of a really big file. Takes a long time!
- Databases have an index to help you find things quickly.
- Some kind data structure, or collection of data structures.

A big database

database
server
memory



database
server
disk



We'll use SQLite

- SQLite is a simple database, supporting the SQL query language, and accessible through many APIs (C, Python, command line etc)
- sqlite3 is the Node module interfacing to SQLite
- SQLite saves data in a single file, right in our server directory. Not suitable for big projects!
- Although the database is a single file, SQLite uses fancy file access techniques to pick out records in the middle, using an index

SQL

- SQL is one, ancient kind of database interface
- It's so standard that databases that do not use SQL are called NoSQL
- SQL is a declarative language – you specify what you want, not what computations the database should use to do it
- Let the clever database programmers figure out the best way to do what you want
- Loose standard, many variants

SQL Database

- An SQL database is made up of tables
- A table is similar to a spreadsheet
- Columns can contain arrays or strings as well as numbers
- Our 5-column table

Rowid	**User**	**English**	**Korean**	**times seen**	**times correct**
1	1	Excuse me…	실례합니다…	0	0
2	1	Where is the train station?	기차역은 어디 있습니까?	0	0

For now…

- We'll add cards to the database in this assignment
- User can always be 1, seen and correct can always be 0
- Later, we'll have multiple users
- Later, we'll keep track of how many times each card was seen, how many times the user got it right, and use those to decide which cards to show.

Database set up

- Before we can store any cards, we need to set up the database
- Tell SQLite3 things like file name, column names, data types
- When do we do this?

Database set up

- Before we can store any cards, we need to set up the database
- Tell SQLite3 things like file name, column names, data types
- When do we do this?

We need to set up the database ***once****, before the server runs. Data in db file remains on disk, even when server is not running.*

Database setup is it's own program, not part of server.

Database set up

- Install sqlite3 (npm install squlite3)
- Require it at the top of the file (call it sql)
- Open a database file:

  let dbFile = 'flashcards.db';

  let db = new sql.Database(dbFile);
- db is now an object that has methods for running SQL commands.
- Stuff written to the database by our program will be stored in the file flashcards.db

Making a table

- Our database will contain one table
- SQL CREATE command sets up a table, defines its columns:

```
CREATE TABLE flashcards (
user INT, english TEXT,  korean TEXT,  seen INT, correct
    INT )
```

- This has just five columns. What happened to that ID column?

Default column “rowid”

- Always present
- Always a unique integer id identifying the row
- By default, it is the PRIMARY key, meaning that it is the fastest way to get to one particular row

Giving an SQL command to sqlite3

- In node.js, we put the command into a string, and we pass the string to the db object:

```
const cmdStr = 'CREATE TABLE flashcards (
user INT, english TEXT,  korean TEXT,  seen INT, correct
   INT )';
db.run(cmdStr, tableCreationCallback);
```

The SQL string contains no newlines, and it is in single quotes since SQL uses double quotes.

Callback function

- Every time we send an SQL command operation to the database, we specify a callback function, even if we are not expecting a response.
- We check for errors in the callback function. SQLite is not great about giving error messages so this is really helpful.
- Why do we need to use a callback function instead of waiting for command to return?

Actually, for table creation…

- …waiting for the command to complete would have been fine.
- But when the Server runs a database command, it's important.
- He has to be ready to answer HTTP requests from its many clients (browsers). Can't hang up for any reason.