

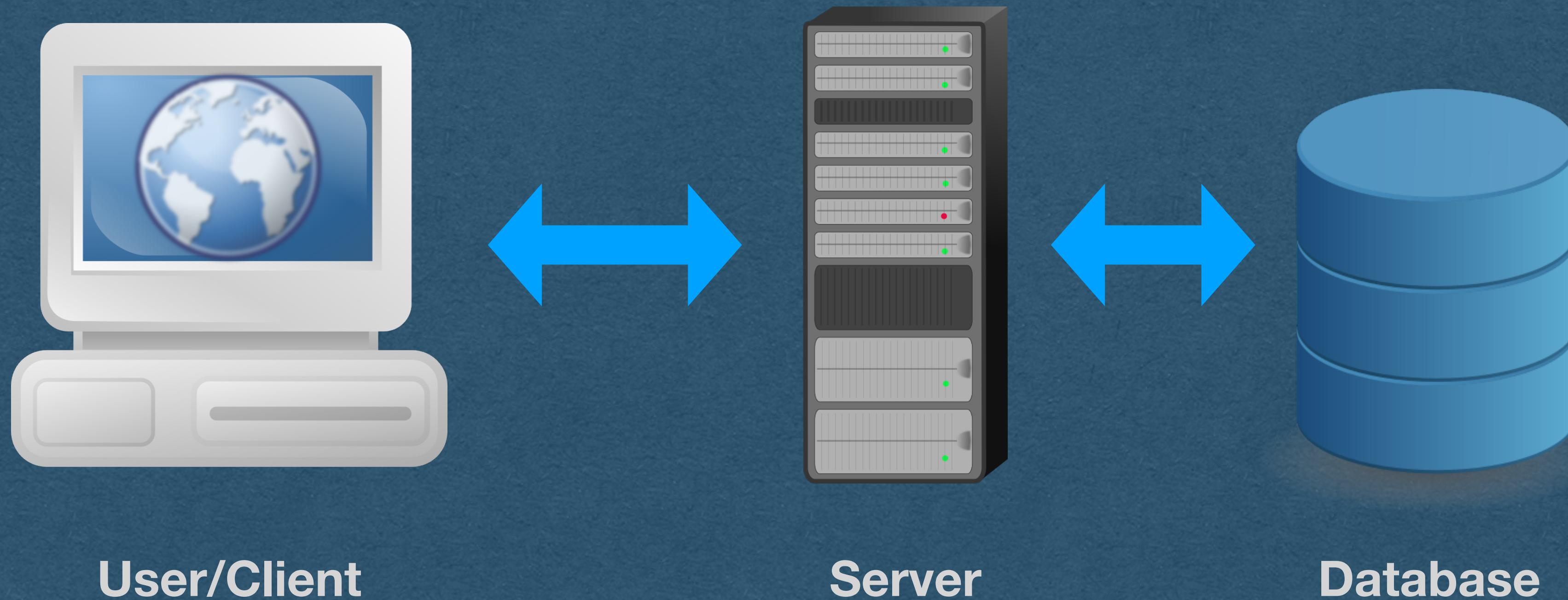
API

Data

- We now have a database that stores app data
- Users have to control data
 - Manage their profile/setting
 - Make posts
 - Use a shopping cart
 - etc.
- How should users interact with stored data?

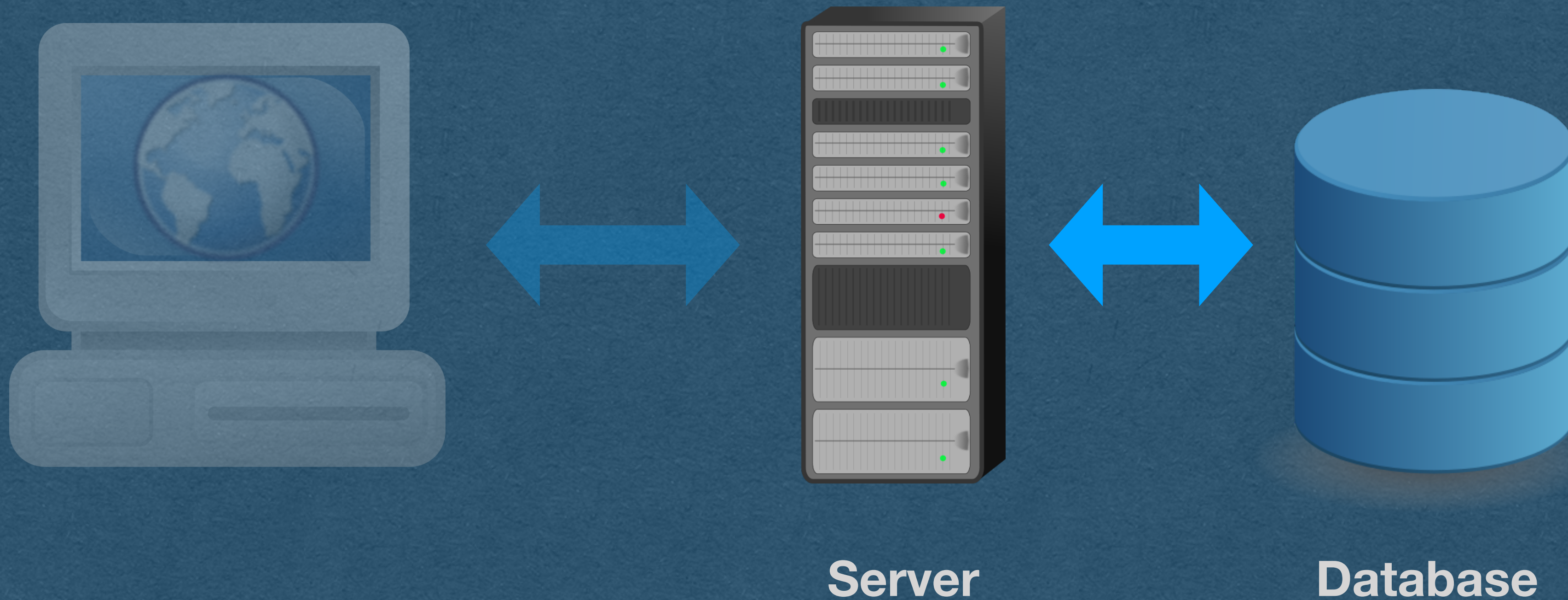
Data

- How do users interact with stored data?



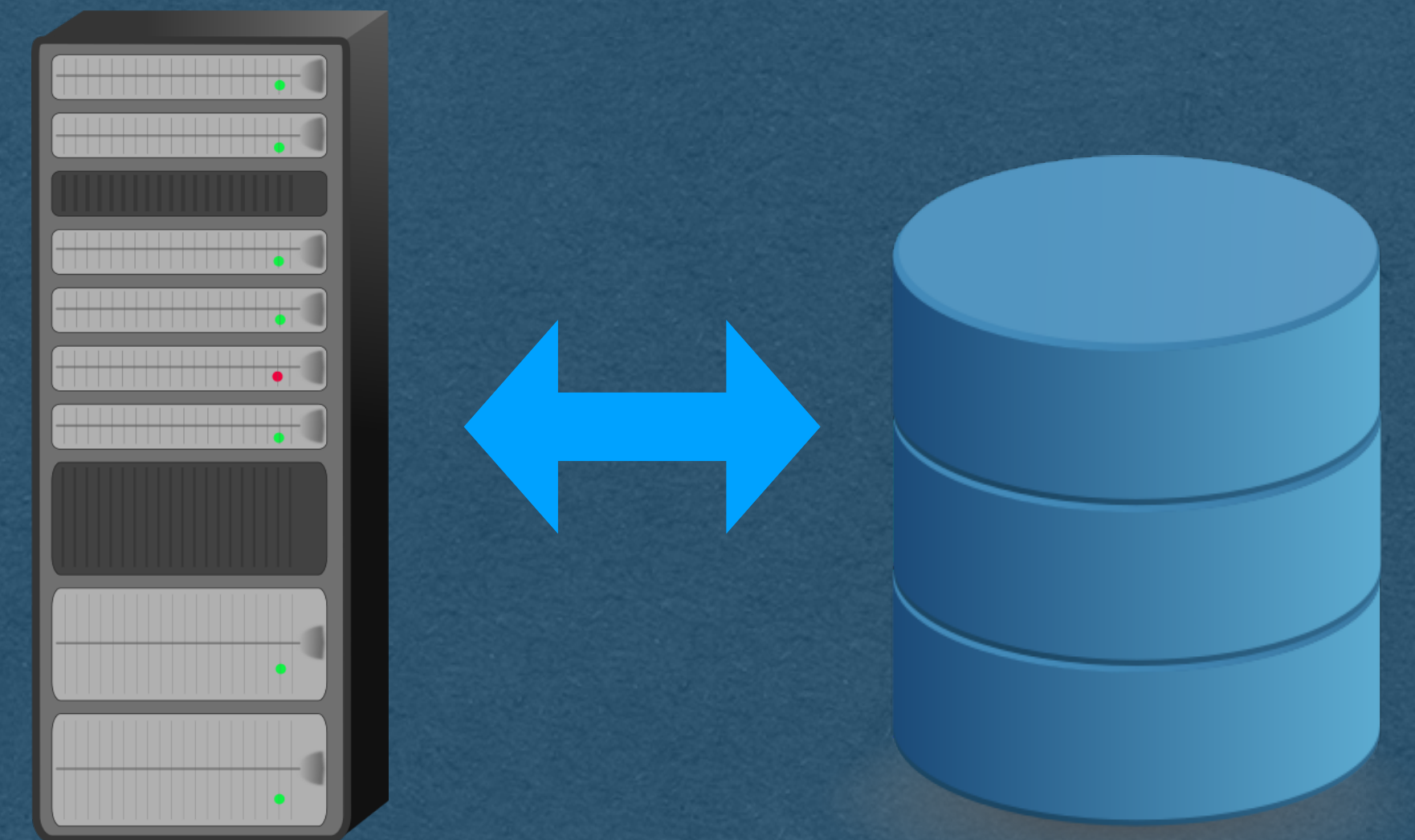
Data

- How does our server interact with stored data?



CRUD

- CRUD is an acronym for the 4 basic operation used to control data
 - **Create**
 - **Retrive**
 - **Update**
 - **Delete**



CRUD - Create

- Create a new record
- INSERT INTO user (?, ?)
- `userCollection.insert_one({"email": "...", "username": "..."})`

CRUD - Create

- When a record is created, it should be assigned a unique id
- This id will be used to identify the created record
- The id is typically an auto-incrementing integer
 - First record had id==1, second has id==2, etc
- MySQL can generate these ids for you
 - `CREATE TABLE user (id int AUTO_INCREMENT, ...)`

CRUD - Create

- MongoDB does not have an auto-increment feature
- You can either:
 - Manage your own auto-incrementing ids
 - Maintain a collection that remembers the last used id
 - Increment the id each time a record is created
 - Or generate your ids any other way you'd like
 - Make sure the id's are unique
 - Id's must be UTF-8 compatible if they will be used in a url

CRUD - Retrieve/List

- Retrieve all records
 - `SELECT * FROM user`
 - `userCollection.find({})`
- Retrieving all records is often called **List**
 - Technically, the acronym is **CRUDL** when list operations are allowed

CRUD - Retrieve

- Retrieve a single existing record
- `SELECT * FROM user WHERE id=3`
- `userCollection.find_one({"id":3})`

CRUD - Update

- Update an existing record
- `UPDATE user SET email=?, username=?
WHERE id=5`
- `userCollection.update_one({"id":5}, {"$set":
{"email":"...", "username":"..."}})`

CRUD - Update

- Can update all fields except the id
- The id technically *can* change, but you should **never** change it
- It is a unique identifier

CRUD - Delete

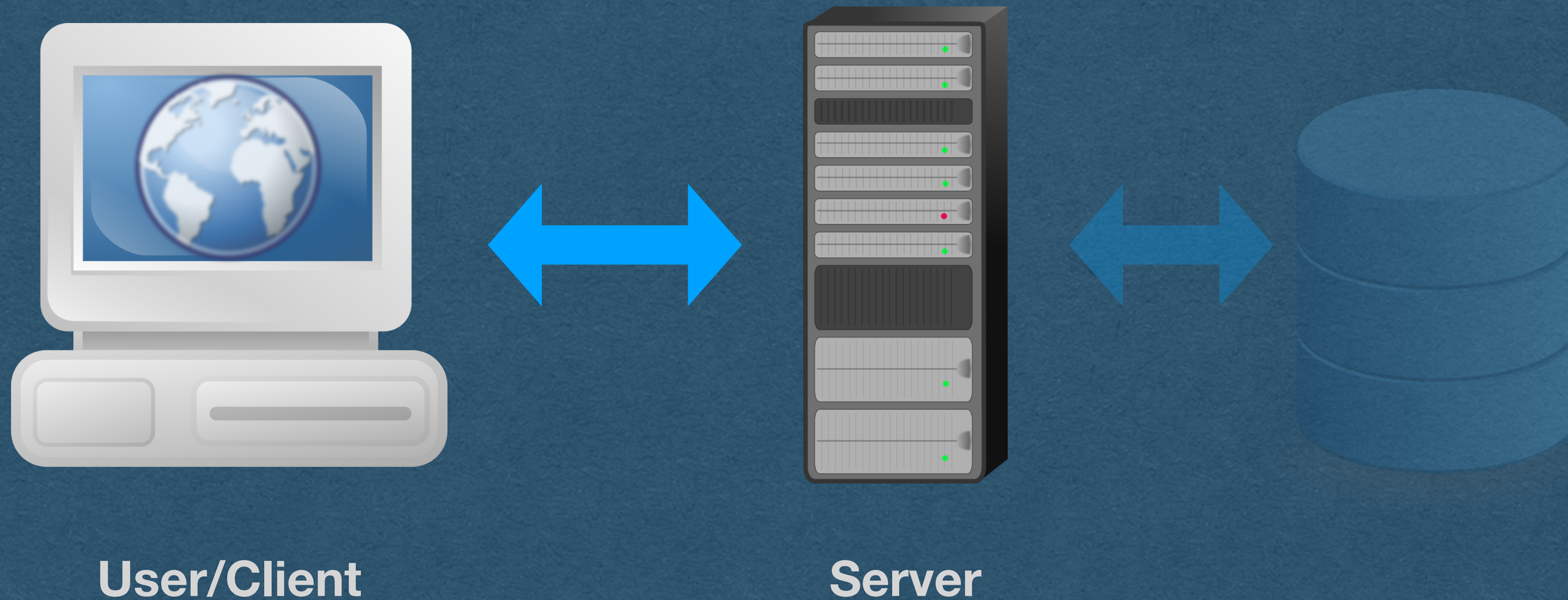
- Delete an existing record
- `DELETE FROM user WHERE id=2`
- `userCollection.delete_one({"id":2})`

CRUD - Delete

- In practice, common to "soft delete"
 - Don't actually delete the data
 - Instead, mark it as deleted
 - Do not allow retrieve/update operations on data marked as deleted
- Soft deletion allows sys admins to perform additional operations
 - eg. User requests to undo an accidental delete
 - Preserves history (Helpful for debugging)
- For your HW, it's fine to "hard delete"

Data

- How do users interact with our server?



HTTP Requests

- GET
 - Request data from the server (Retrieve)
- POST
 - Send data to the server (Create)
- PATCH
 - Update a resource (Update)
- PUT
 - Replace an existing record (Update)
- DELETE
 - Delete a resource (Delete)

HTTP - POST v. PATCH v. PUT

- Both POST, PATCH, and PUT are all used to send data to the server, but with different expectations
- POST
 - Requires the server to process the data
 - eg. Generating the id for a created record
- PATCH
 - Make a partial update to an existing record
 - eg. Update only the content of a chat message, but not the author
- PUT
 - Replace an entire existing record
 - Must be *idempotent*

HTTP - Idempotent

- When multiple identical HTTP requests are sent
- If the requests are idempotent, they will have the same effect on the server as sending a single request
- The additional requests will not change the data of the API
- In math terms, if our request is a function f
 - $f(f(x)) == f(x)$

HTTP - Idempotent

- GET and DELETE are idempotent
- GET should not change the data/state of the API
- Only retrieve data
- Deleting a record twice has the same effect on the API as deleting the record once

HTTP - Idempotent

- PUT must be **idempotent**
- PUT will replace the entire record with the data of the request
- A second identical PUT doesn't change anything since the record was already replaced

HTTP - Idempotent

- POST is **not** idempotent
- Since the server is processing the data, there is no implied idempotent property
- eg. Sending 2 identical POST requests to create a record will result in 2 records being created with different ids

HTTP - Idempotent

- PATCH is **not** idempotent
- In practice, PATCH endpoints are *usually* idempotent
- There is no expectation that they **must** be idempotent
- Eg. A record that tracks a counter or how many times it's been updated

RESTful API

- REST -> **RE**presentational **S**tate **T**ransfer
- We'll use HTTP requests to interact with API data
- REST is designed to simplify the way data is used
- Improve reliability and scalability

REST and CRUD

- User sends HTTP requests that correlate to CRUD operations on the data
- POST => Create
- GET => Retrieve
- PUT => Update
- DELETE => Delete

RESTful API

- REST is fairly loosely defined (No RFC)
 - *Or loosely understood*
- Typically measured on a spectrum
 - An API can be more/less RESTful
 - "We *could* do that, but it's not very RESTful"
 - "Let's refactor our API to make it more RESTful"

REST Constraints

- **Client-Server architecture and statelessness**
 - Both constraints are implicit when using HTTP
- The use of cookies in a RESTful API would be a violation of statelessness
- Usually accepted in practice (API tokens)

REST Constraints

- **Cacheability**
 - Each response must contain caching information
 - Requests should be cached if possible
 - Avoid stale data from being cached

REST Constraints

- **Layered-System**
 - The API should have the ability to add additional layers between it and the client
 - Ex: Client interacts with a load balancer that delegates to many instances of your API
 - Ex: A reverse proxy server is added that encrypts all traffic (HTTPS)
 - Ex: The client uses a VPN

REST Constraints

- **Uniform Interface**
 - Resources are defined in the requests
 - The user is given, in a response, enough information to update/delete the resource
 - A request contains all information needed to handle that request
 - The API should be self-contained (No reliance on documentation that cannot be accessed from an API path)

Data

- Users interact with our RESTful API
- API requests correlate to CRUD operations

