

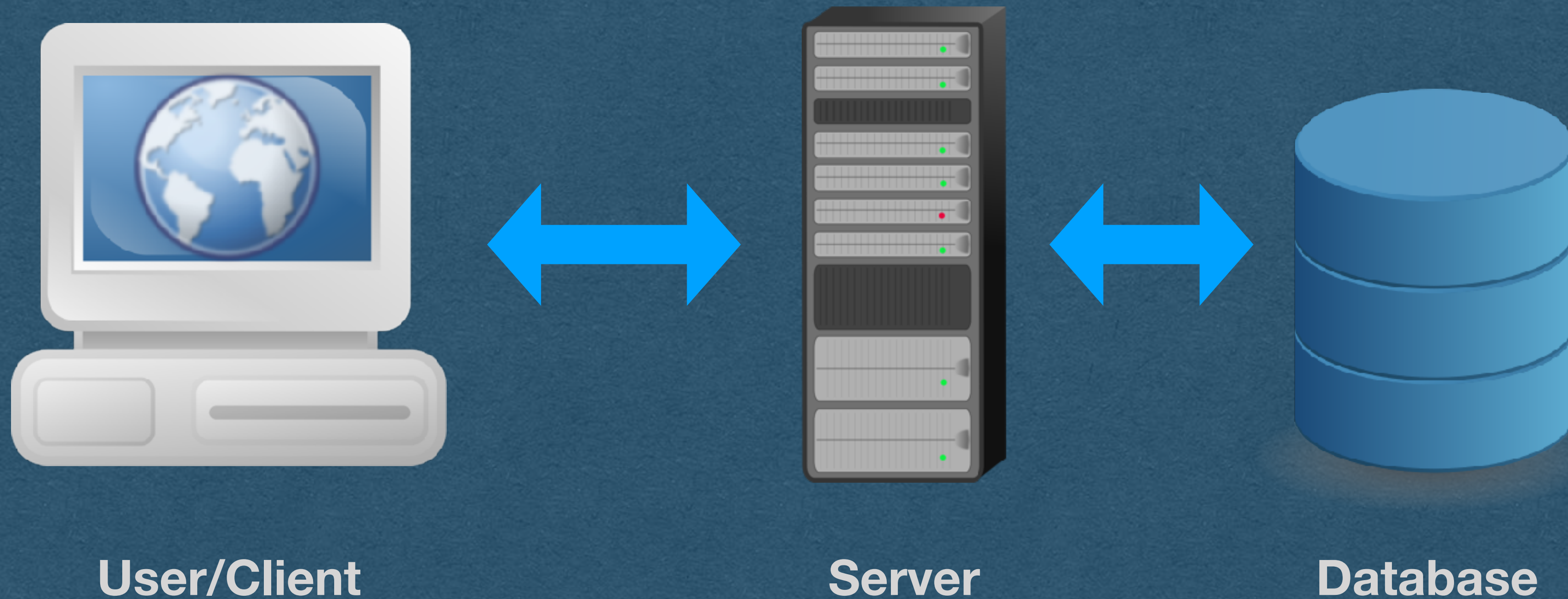
API

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?

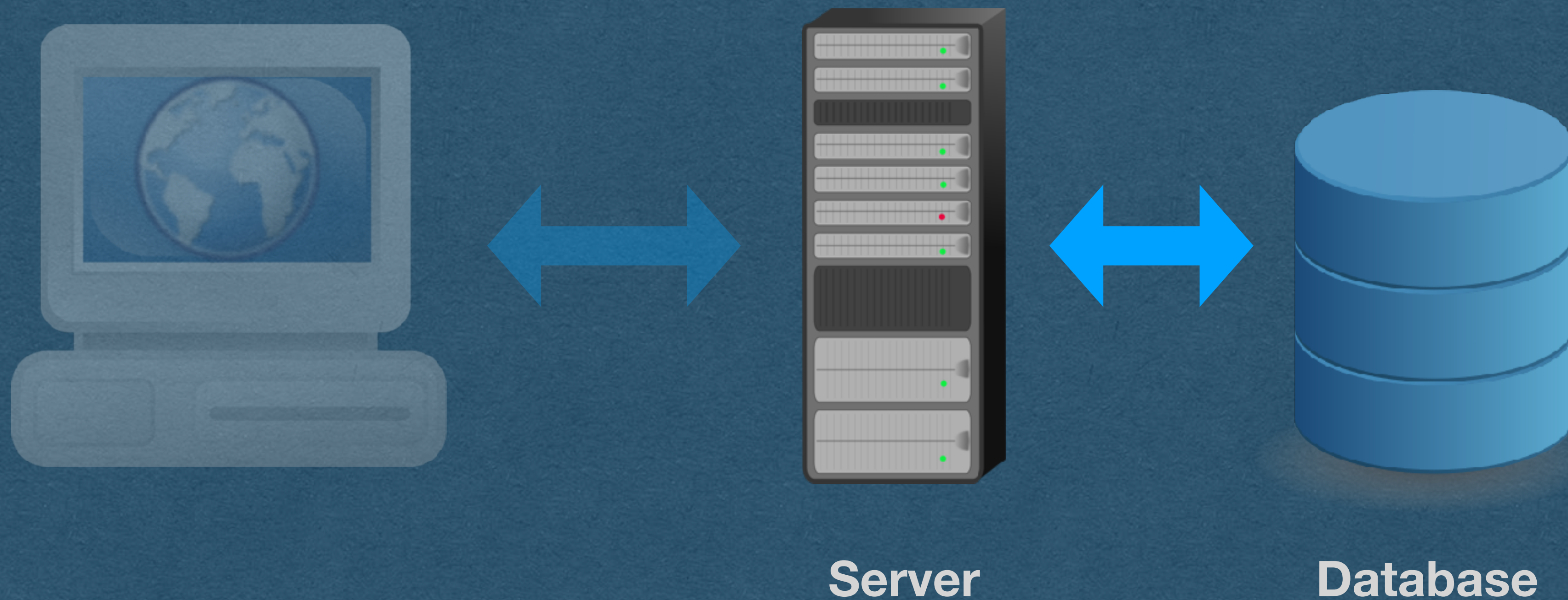
Data

- 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({"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
- Let your database generate the ids
 - `CREATE TABLE user (id int AUTO_INCREMENT, ...)`

CRUD - Create

- MongoDB does not have an auto-increment feature
- You must manage your own ids as integers
 - Maintain a collection that remembers the last used id
 - Increment the id each time a record is created
- Do not use the default "_id"
 - It is not an integer and not allowed on the HW

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({"id":3})`

CRUD - Update

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

CRUD - Update

- Can update all fields except the id
- The id *can* change, but you should never change it

CRUD - Delete

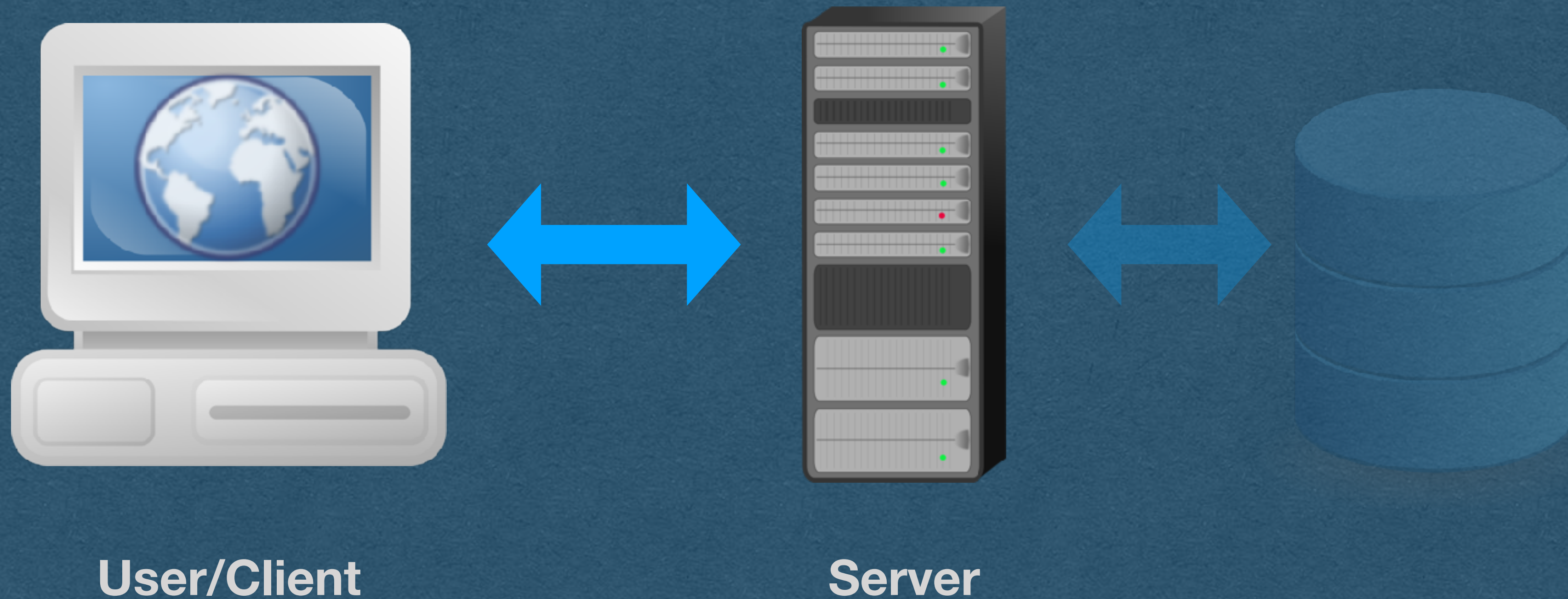
- Delete an existing record
- `DELETE FROM user WHERE id=2`
- `userCollection.delete({"id":2})`

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

Data

- How do users interact with our server?



HTTP Requests

- GET
 - Request data from the server (Retrieve)
- POST
 - Send data to the server (Create)
- PUT
 - Create or update a resource (Update)
- DELETE
 - Delete a resource (Delete)

HTTP - POST v. PUT

- Both POST and PUT are used to send data to the server
- POST
 - Requires the server to process the data
 - eg. Generating the id for a created record
- PUT
 - Directly create/update a record
 - Server does not process the data of the request
 - Must be idempotent

HTTP - Idempotent

- When multiple identical HTTP requests are sent
- If the requests are idempotent, they will have the same effect as sending a single request
- The additional requests will not change the data of the API

HTTP - Idempotent

- GET is idempotent
 - Only retrieve data
 - GET should not change the data of the API

HTTP - Idempotent

- PUT and DELETE requests must be **idempotent**
- eg. A second identical PUT doesn't change anything since the change was already made
- eg. Deleting a record twice has the same effect on the API as deleting the record once

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

RESTful API

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

RESTful API

- REST is fairly loosely defined (No RFC)
 - *Or loosely understood*
- Typically measured on a spectrum
 - An API can be more/less RESTful
 - The API for the HW is *mostly* 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

- **Cacheablility**
 - Each response must contain caching information
 - Requests should be cached if possible
 - Must 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 Proxy server is added that encrypts all traffic (HTTPS)

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

