COMP4021
Internet Computing

RESTful APIs

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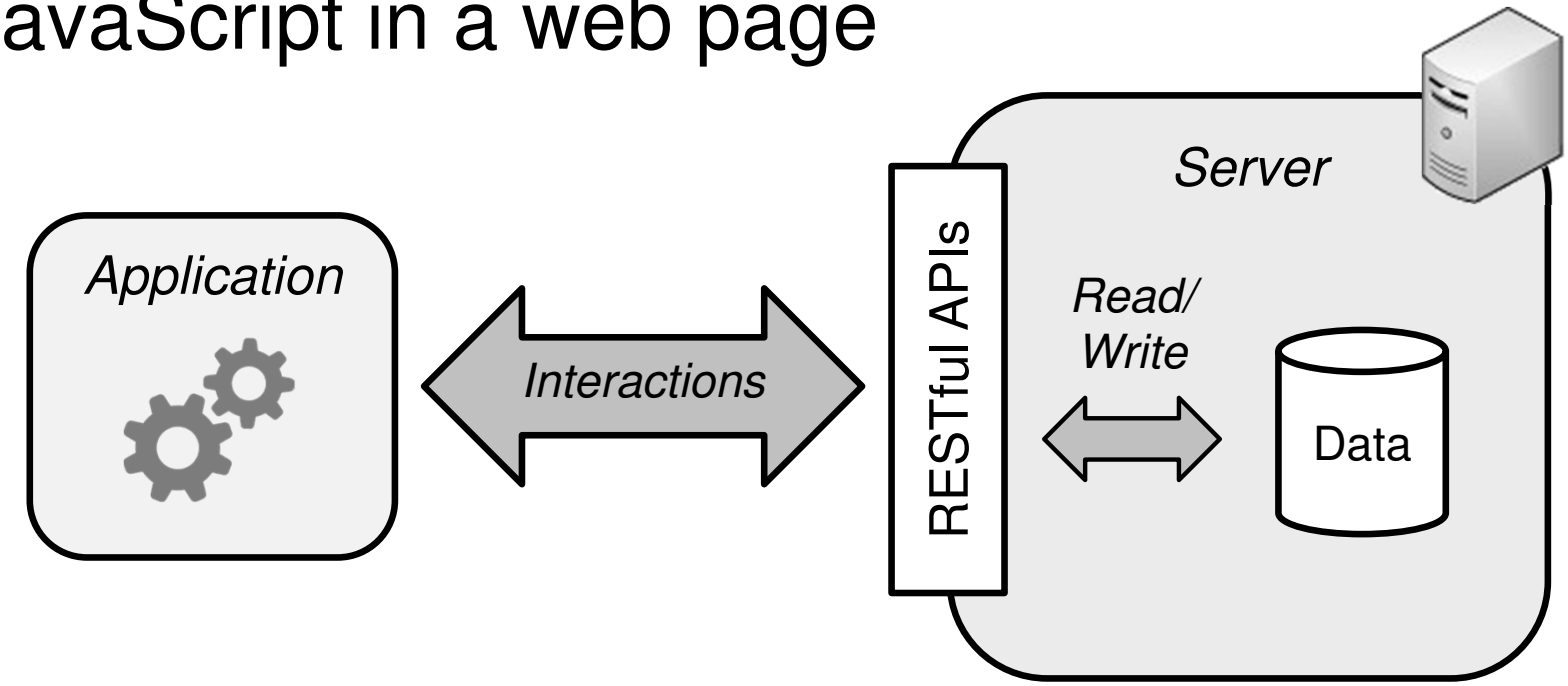
RESTful APIs

- REST stands for **RE**presentative **S**tate **T**ransfer
- It is a set of guidelines that help you create collections of web server endpoints for managing ‘resources’
- These endpoints, generally called RESTful APIs, allow developers to use them easily over HTTP

Overview

- RESTful APIs are usually used by programmers from other applications, such as using JavaScript in a web page



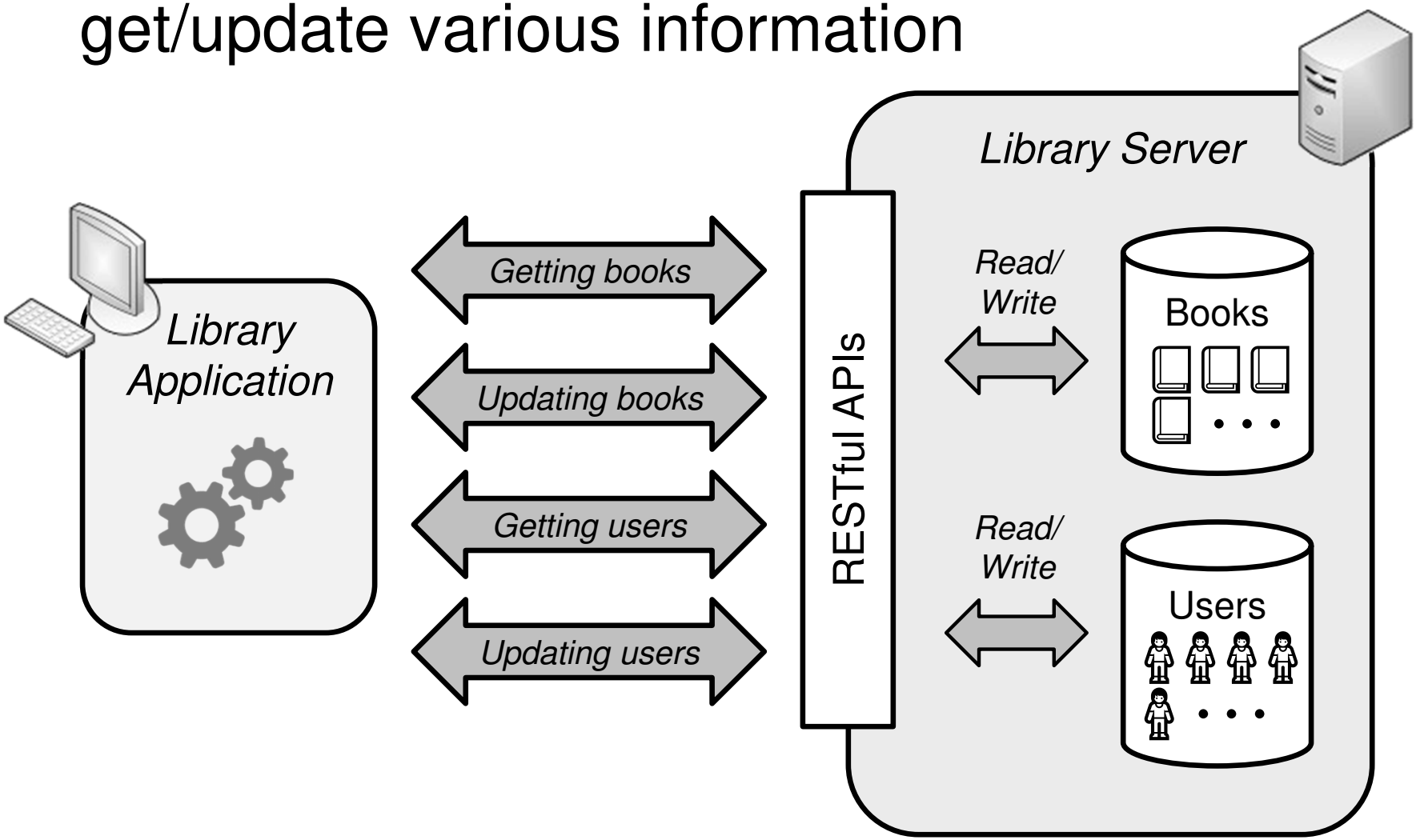
- You don't usually access the APIs as web pages

Managing ‘Resources’

- RESTful APIs are always about managing ‘resources’, which are typically data stored on a server
  - For example, managing user records and book records stored in a library system
- They don’t work on multiple things at the same time and don’t work on relationships
  - For example, they don’t do things like enrolling students into a course

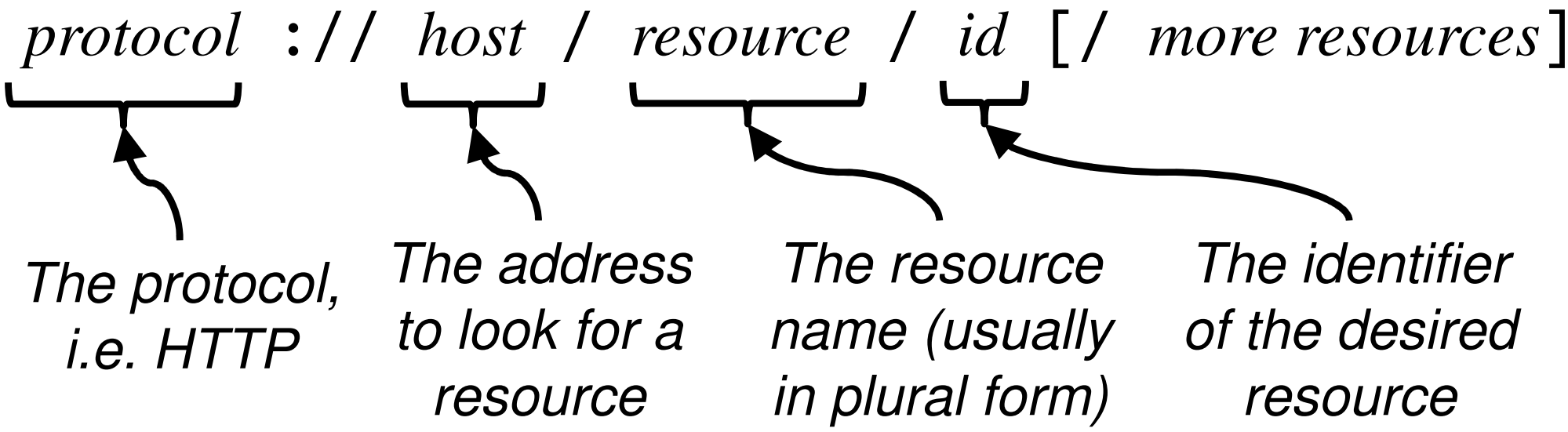
An Example System

- Here is an example library application that communicates with the library server to get/update various information



The API Interface

- RESTful APIs use a ‘uniform interface’, when accessing resources
- When the APIs are used over HTTP, the interface is simply a URL
- It is divided into different parts, like this:



Example Interfaces

- Getting a book with an id of 2:

```
http://books.com/books/2
```

- Getting the computer information of a room:

```
http://ustrooms.edu/rooms/2465/
        computers/1
```

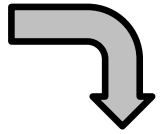
- Getting all students of the CSE major:

```
http://mystudents.edu/majors/cse/
        students/
```

Data Transfer

- When getting resources from a RESTful server, they are typically represented by JSON, as shown in this example:

`http://books.com/books/2`



- However, you can also return things in any format you want

```
{
  "id":2,
  "title":"The Snow Queen",
  "author":"H. C. Andersen",
  "Year":1944
  ...
}
```

Using REST in an Express Server

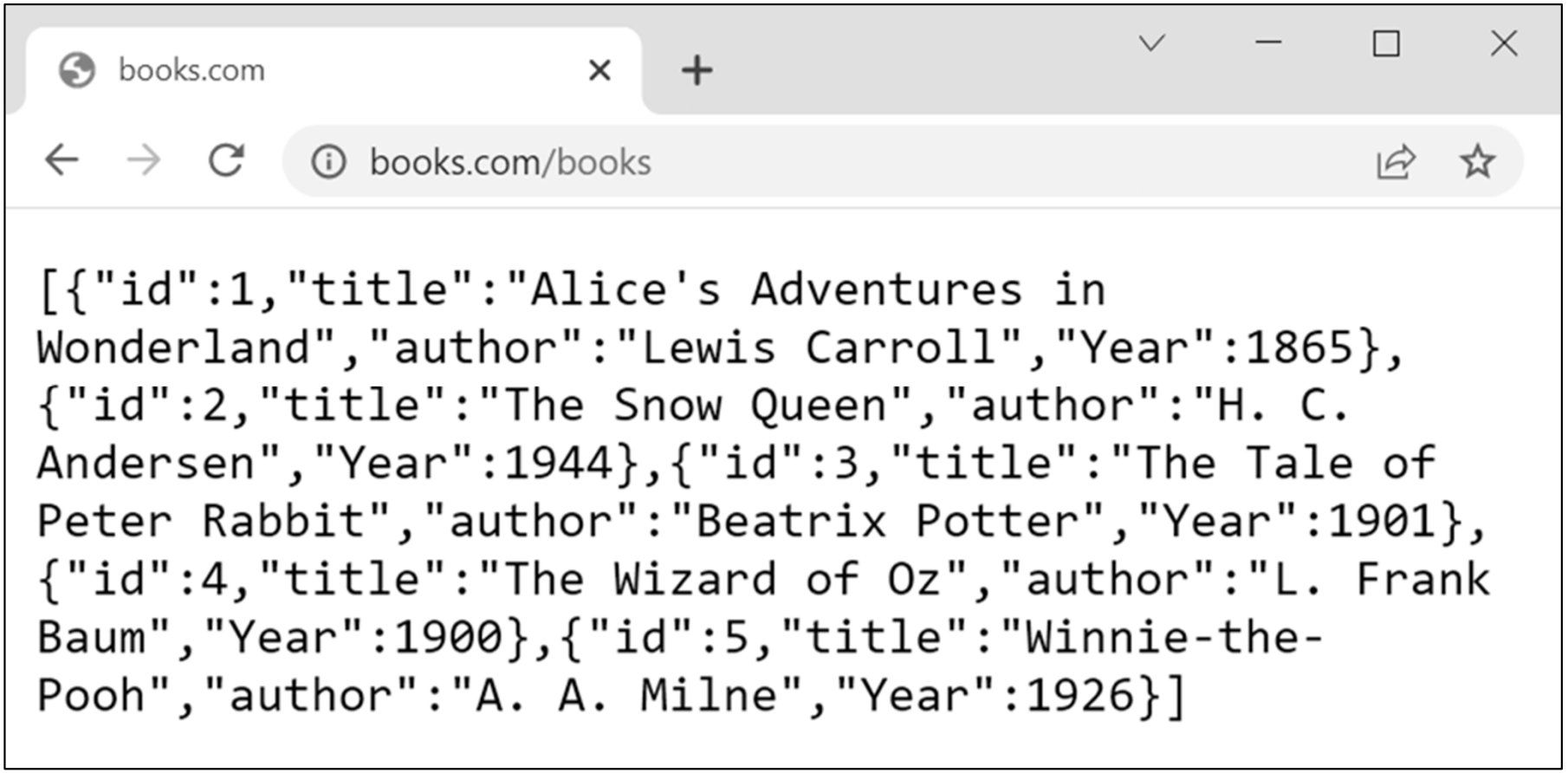
- You can make a RESTful server using Express endpoints
- For example, here is an endpoint to return all books in a library system:

```
app.get("/books", (req, res) => {
    ...Retrieve the books...

    res.json(...all books...);
});
```

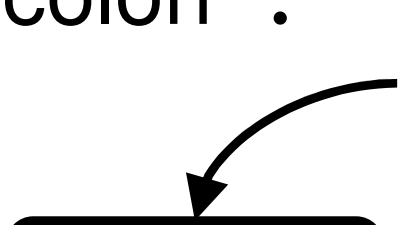
Showing an Example Output

- Since it is a `GET` request, you can see the output of the endpoint using a browser, like this:



Getting Individual Resources

- When getting an individual resource using a resource id, you can set up the Express endpoint using a colon ':'

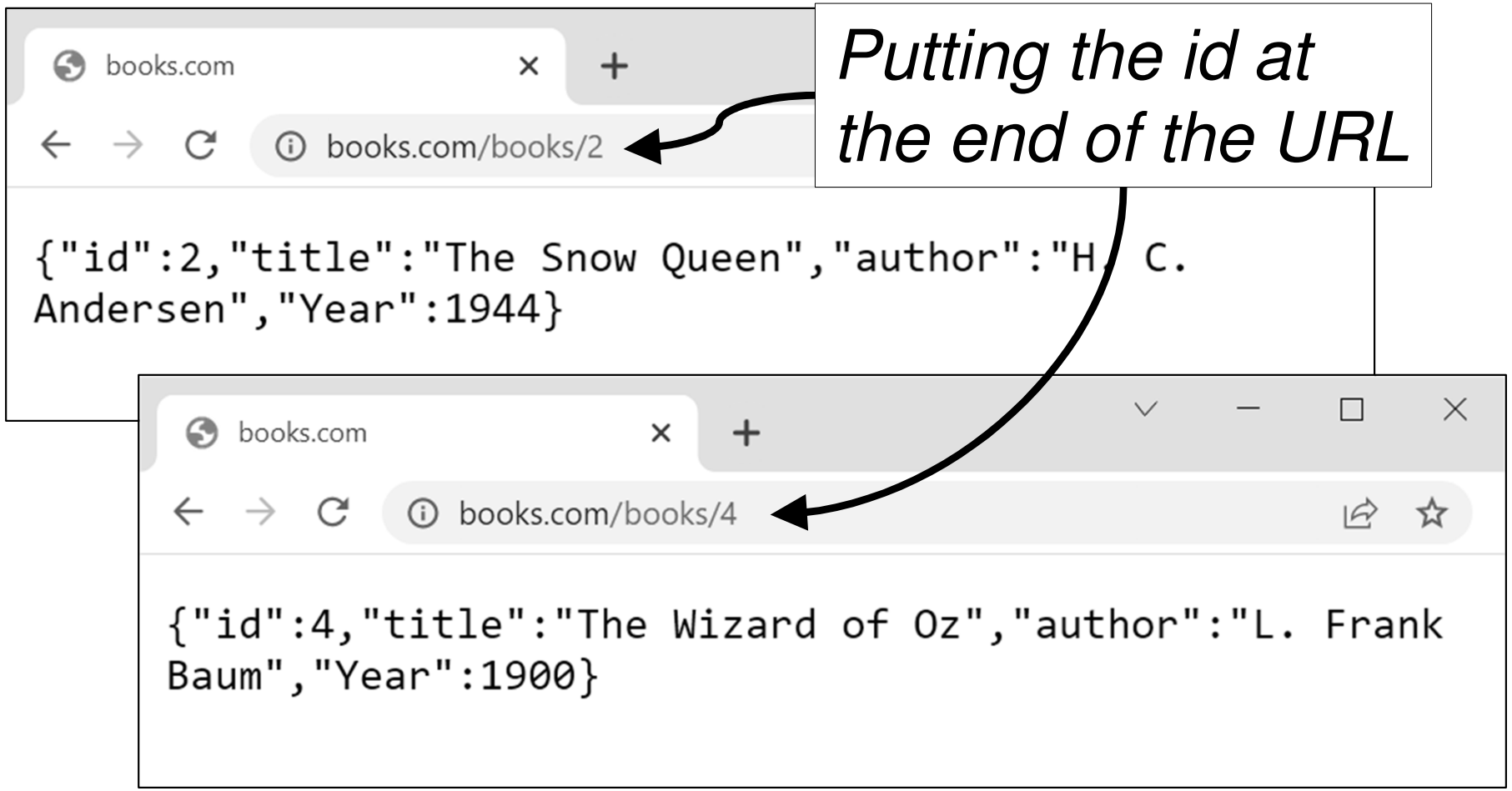



```
app.get("/books/:bookId", (req, res) => {
    const bookId = req.params.bookId;
    ...Retrieve the book using the id...

    res.json(...the requested book...);
});
```

Getting Example Books

- For example, individual books in a library system can be shown in a browser:



Doing Things With the Resources

- In the previous examples, we only read the resources, you can update them if you want to
- You can do one of the following four operations using RESTful APIs:
  - Reading resources (which we have done already)
  - Creating new resources
  - Updating resources, and
  - Deleting resources

Using HTTP Methods

- A typical web server uses different URLs to serve different purposes
- RESTful APIs work differently; they use HTTP methods to map to the type of things that they perform:
  - The `GET` method for reading
  - The `POST` method for creating
  - The `PUT` method for updating
  - The `DELETE` method for deleting

HTTP Methods and URL

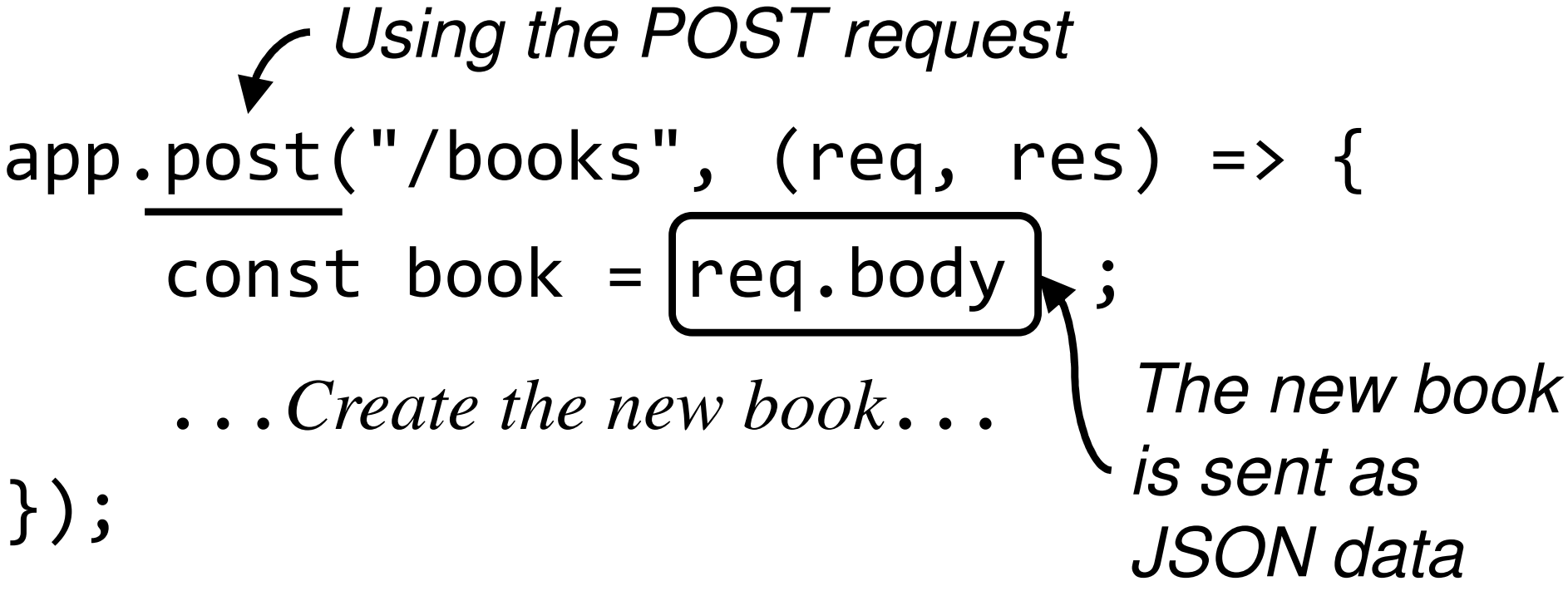
- Even if the same URL is given, a RESTful server may apply two different operations
- For example:
  - If you send a `GET` request to:

    `http://books.com/books/12`

    you will retrieve the book with an id of 12
  - If you send a `DELETE` request to the same URL, you will delete the book!

More Endpoints in Express

- In the next few slides, we will quickly show some additional example endpoints to complete the library's RESTful APIs
- First, you can create new books, e.g.:



Updating Resources

- You can also update the books, e.g.:

This uses the PUT request

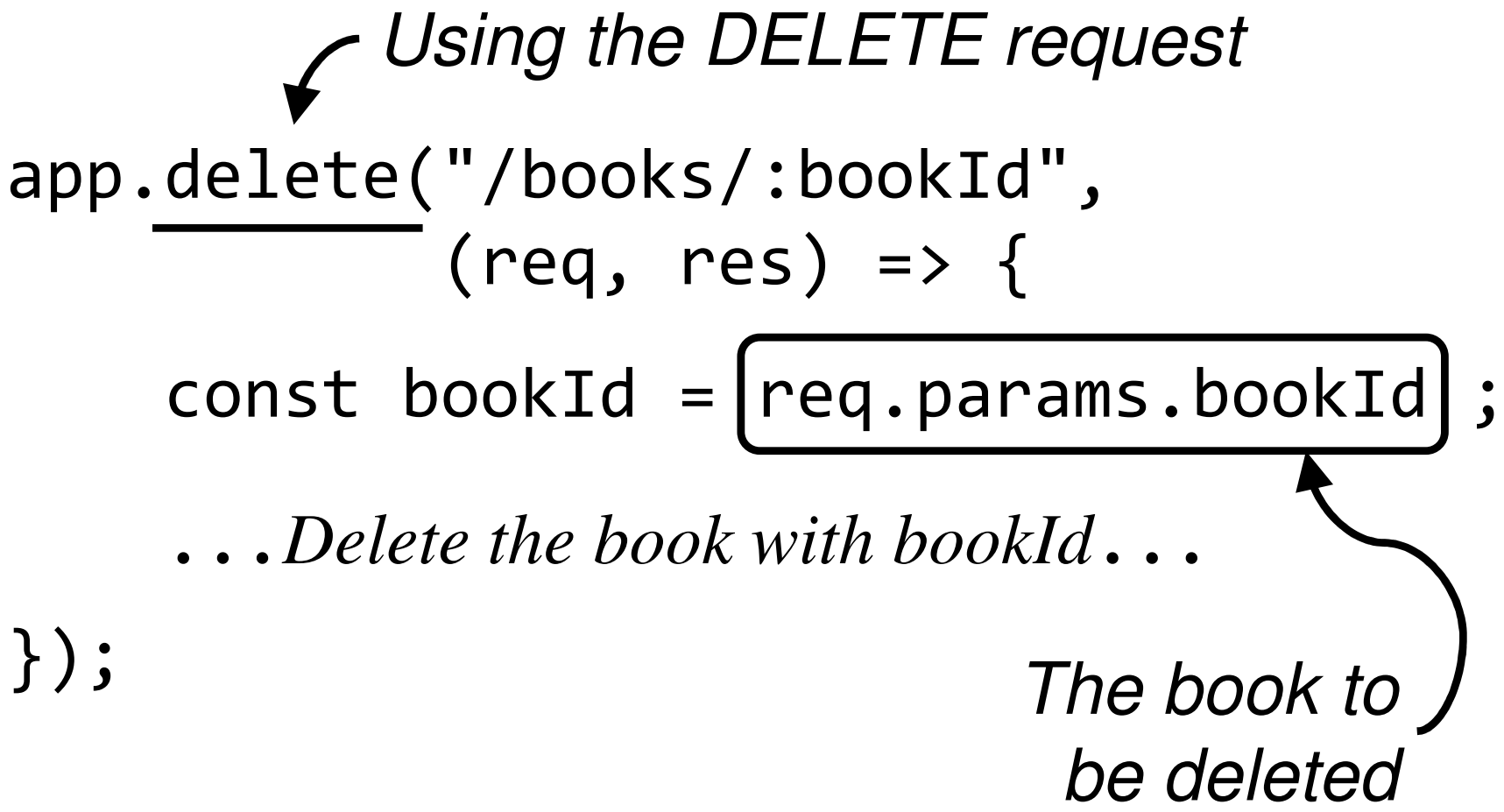
```
app.put("/books/:bookId", (req, res) => {
    const bookId = req.params.bookId;
    const book =   req.body          ;

    ...Update the book with bookId...
});
```

The book to be updated

Deleting Resources

- Finally you can delete any books, e.g.:



Using HTTP Status Codes

- RESTful APIs use status codes to represent their results
- Here are some examples:
  - `200 OK` e.g. successful `GET`, `PUT` or `DELETE`
  - `201 Created` e.g. successful `POST`
  - `400 Bad Request` e.g. bad input
  - `404 Not Found` e.g. invalid resource id

Example of Using Status Code

- For example, if you successfully delete a book, you will return 200; or 404 (not found) otherwise

```
app.delete("/books/:bookId", (req, res) => {
    const bookId = req.params.bookId;
    if (... bookId exists?...) {
        ...Delete the book with bookId...
        res.sendStatus(200);
    }
    else
        res.sendStatus(404);
});
```

Successfully delete the book

Book not found

Checking Status Using fetch()

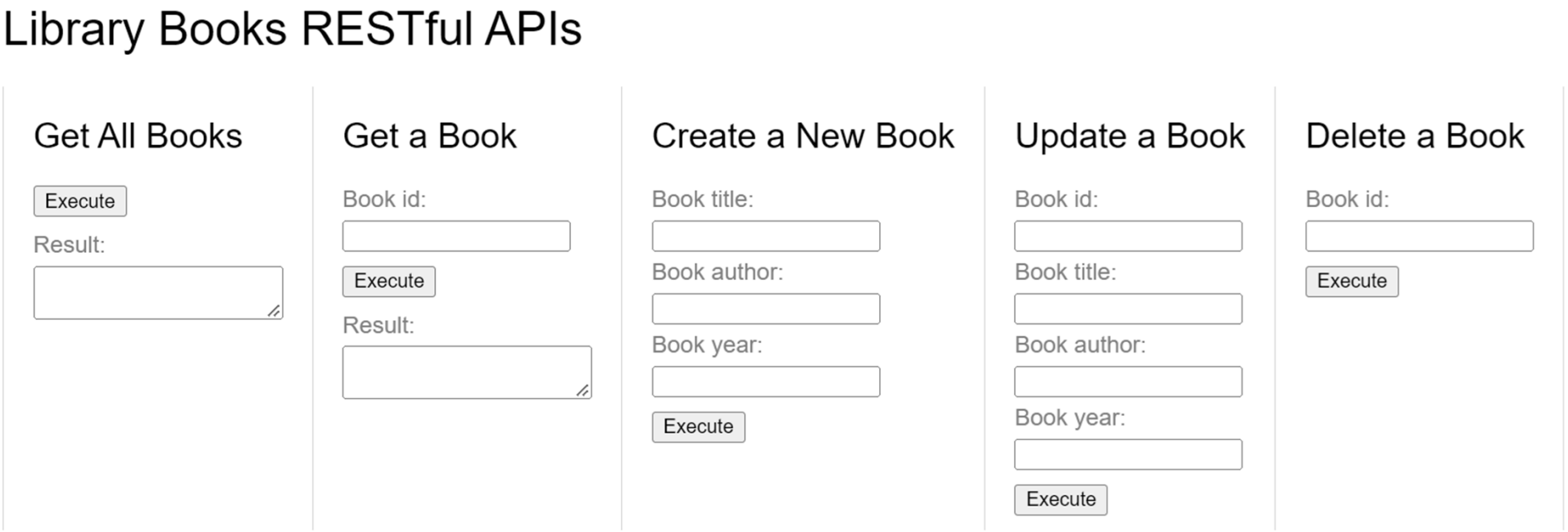
- Back at the browser, you can check the status code in the `response` object when using `fetch()`, as shown below:

```
fetch("/books")
  .then((response) => {
    if (response.status == 200)
      return response.json();
    else
      alert("Failed to get the books!");
  })
  ...
```

Checking status code

A Library APIs Example

- An example page has been created to test the library's APIs that we have shown so far:



The five RESTful APIs' endpoints can be tested using these HTML inputs