Databases & ORMs

You will be able to...

- Give a definition for **ORM** and explain its **pros/cons**
- ***Define* models** in Sequelize
- ***Associate* models** with each other
- Hook into **Sequelize lifecycle events**
- ***Query* models** via `findAll`, `findOne`, `create`, and other methods

Object-Relational Mapper

- Acts as a “bridge” between your code and the rDBMS
- Using ORM, data can be easily stored and retrieved from a database *without* writing SQL statements directly

Object-Relational Mapper

An ORM is a program used to convert data between incompatible type systems using object-oriented programming languages. This creates a "virtual object database" that can be used from within the programming language.

Wikipedia: Object-relational mapping

Sequelize

- **Sequelize is an Object-Relational Mapper (ORM)**
- **Accesses SQL databases from Node.js**
  - Using JS objects and methods instead of SQL statements
- **Represents tables as “classes” (models) and rows as objects (instances)**

Without ORM

(pg)

```
client.query(`SELECT * FROM guides`)

client.query(`SELECT * FROM venues`)

client.query(`SELECT * FROM users`)
```

Without ORM

(pg)

```
client.query(`SELECT * FROM guides`)
client.query(`SELECT * FROM venues`)
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```

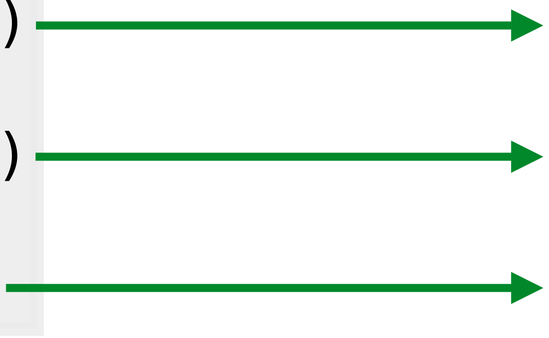

With ORM

(Sequelize)

```
Guide.findAll()
Venue.findAll()
User.findAll()
```

Tables			Models
+		=	+
Rows			Instances

Basic Workflow

Sequelize Basics: Workflow

- **Instantiate Sequelize**

```
const Sequelize = require('sequelize')
const db = new Sequelize('postgres://localhost/wiki')
```

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- **Define your Model(s)**
  - Add options to Model fields
    (validations, default values & more)

```
const User = db.define('user', {
  name: Sequelize.STRING,
  pictureUrl: Sequelize.STRING
});
```

Sequelize Basics: Workflow

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    type: Sequelize.STRING,
    allowNull: false
  },
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  },
  pictureUrl: Sequelize.STRING
});
```

- **Connect/sync** the **Model** to an ***actual* table** in the **database**

```
await User.sync()
```

Sequelize Basics: Workflow

- **Use** the **Model** (Table) to **find/create Instances** (row)

```
const users = await User.findAll();
```

Sequelize Basics: Workflow

- **Use** the **Model** (Table) to **find/create Instances** (row)

```
const person = new User({
  name: "Kate",
  pictureUrl: "http://fillmurrary.com/10/10"
});
```

- **Use** the **Instances** to **save** / **update** / **delete**

```
await person.save();
```

DEMO

Additional Model Options

- Sequelize models can be extended: **Hooks**, **Class & Instance Methods**, **Getter & Setters**, **Virtuals**, etc.

Hooks

Hooks

- **When you perform various operations in Sequelize (creating, updating, destroying, etc), various "events" occur. These are called "lifecycle events"**

- **Hooks are like adding an event listener to these events**
  - *"Every time a journal entry is created or updated, escape any dangerous sequences that could result in an XSS attack"*
  - *"Every time a user is updated with a new password, hash it so that the plaintext password doesn't get saved in the database"*

What happens when we do this?

```
const pug = await User.create({
  name: "Cody",
  pictureUrl: "http://fillmurray.com/10/10"
});
```

beforeValidate

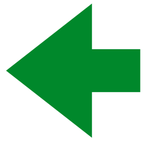
validation

afterValidate

beforeCreate

creation

afterCreate

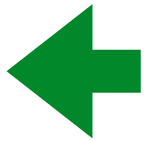


```
User.beforeValidate((user) => {

})
```

beforeValidate

validation



afterValidate

beforeCreate

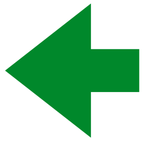
creation

afterCreate

beforeValidate

validation

afterValidate



beforeCreate

creation

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User.afterValidate((user) => {

})
```

beforeValidate

validation

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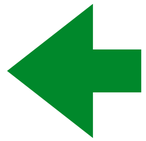


creation

afterCreate

```
User.beforeCreate((user) => {

})
```

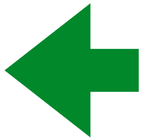
beforeValidate

validation

afterValidate

beforeCreate

creation



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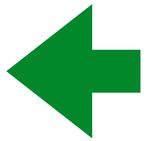


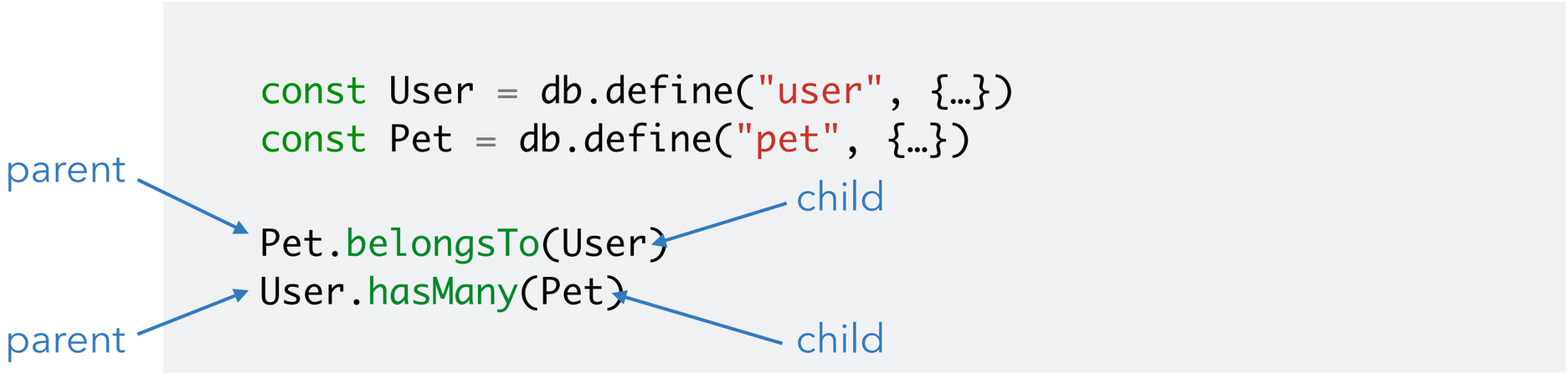
```
User.afterCreate((user) => {

})
```

Associations

Associations

- **Establishes** a **relationship** between **two tables** using a…
  - **foreign key** (one-to-one and one-to-many relationships), or a
  - **join table** (many-to-many relationships)
- **Creates** several **special instance methods (like `getAssociation` & `setAssociation`),** that an **instance** can use to **search for the instances that they are related to**
- **And more… (eager loading** [i.e. `include`]**, etc)**
  - Just an inner join

Associations



Associations

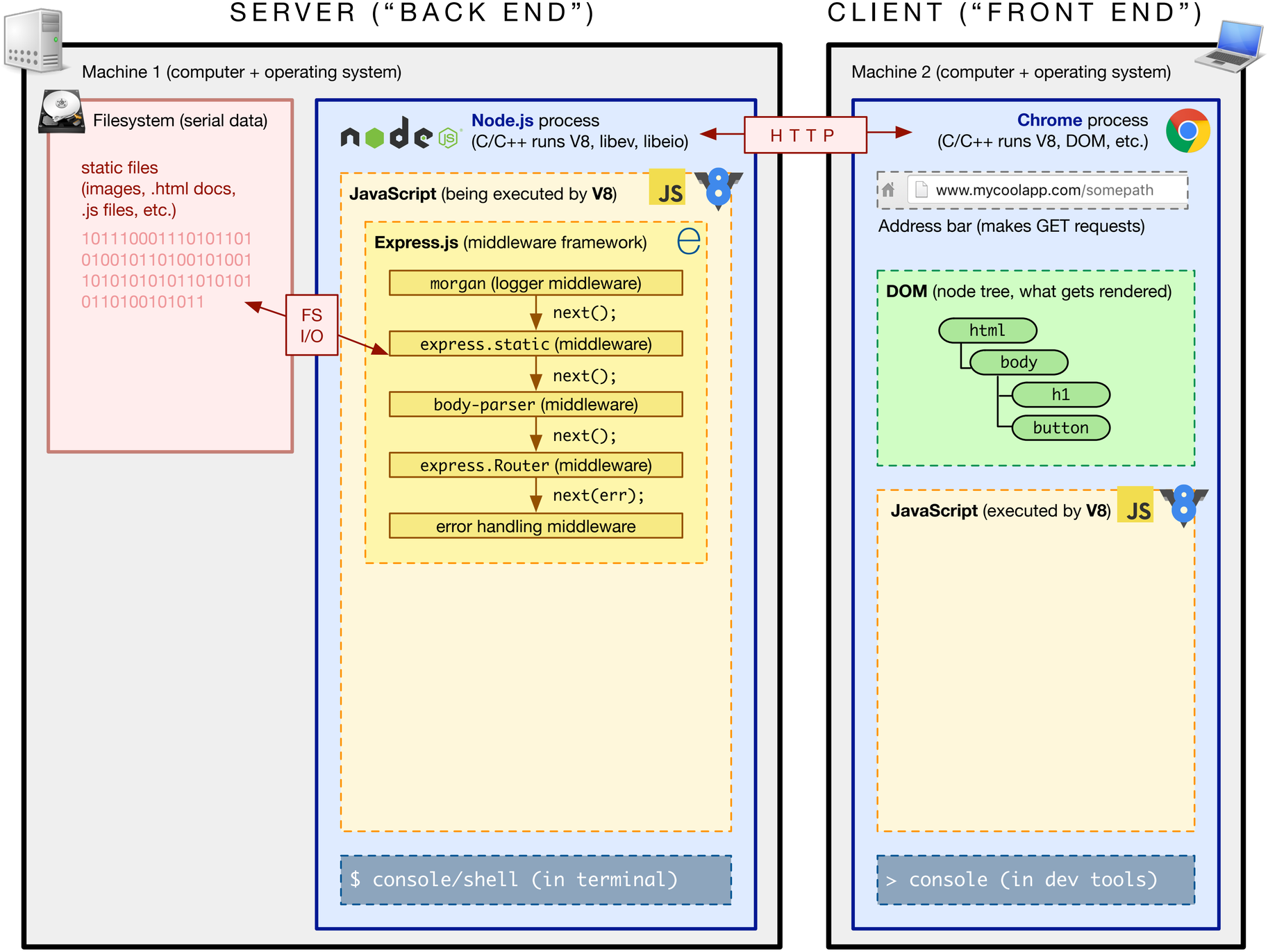
```
const User = db.define("user", {…})
const Pet = db.define("pet", {…})

Pet.belongsTo(User)
User.hasMany(Pet)
```

```
const someUser = await User.findByPk(12)
const someUsersPets = await someUser.getPets()
```

A little more context

Sequelize

- Lives inside Node.js process
- Knows how to communicate to a few SQL DBMSs, including PostgreSQL, MySQL and sqlite3


SERVER ("BACK END")
CLIENT ("FRONT END")
Machine 1 (computer + operating system)
Machine 2 (computer + operating system)
Filesystem (serial data)
static files
(images, .html docs,
.js files, etc.)
10111000111010110101001010110100101001010101011010101011010010101011
FS
I/O
Node.js process
(C/C++ runs V8, libev, libeio)
HTTP
Chrome process
(C/C++ runs V8, DOM, etc.)
JavaScript (being executed by V8)
JS
Express.js (middleware framework)
morgan (logger middleware)
next();
express.static (middleware)
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next();
express.Router (middleware)
next(err);
error handling middleware
www.mycoolapp.com/somepath
Address bar (makes GET requests)
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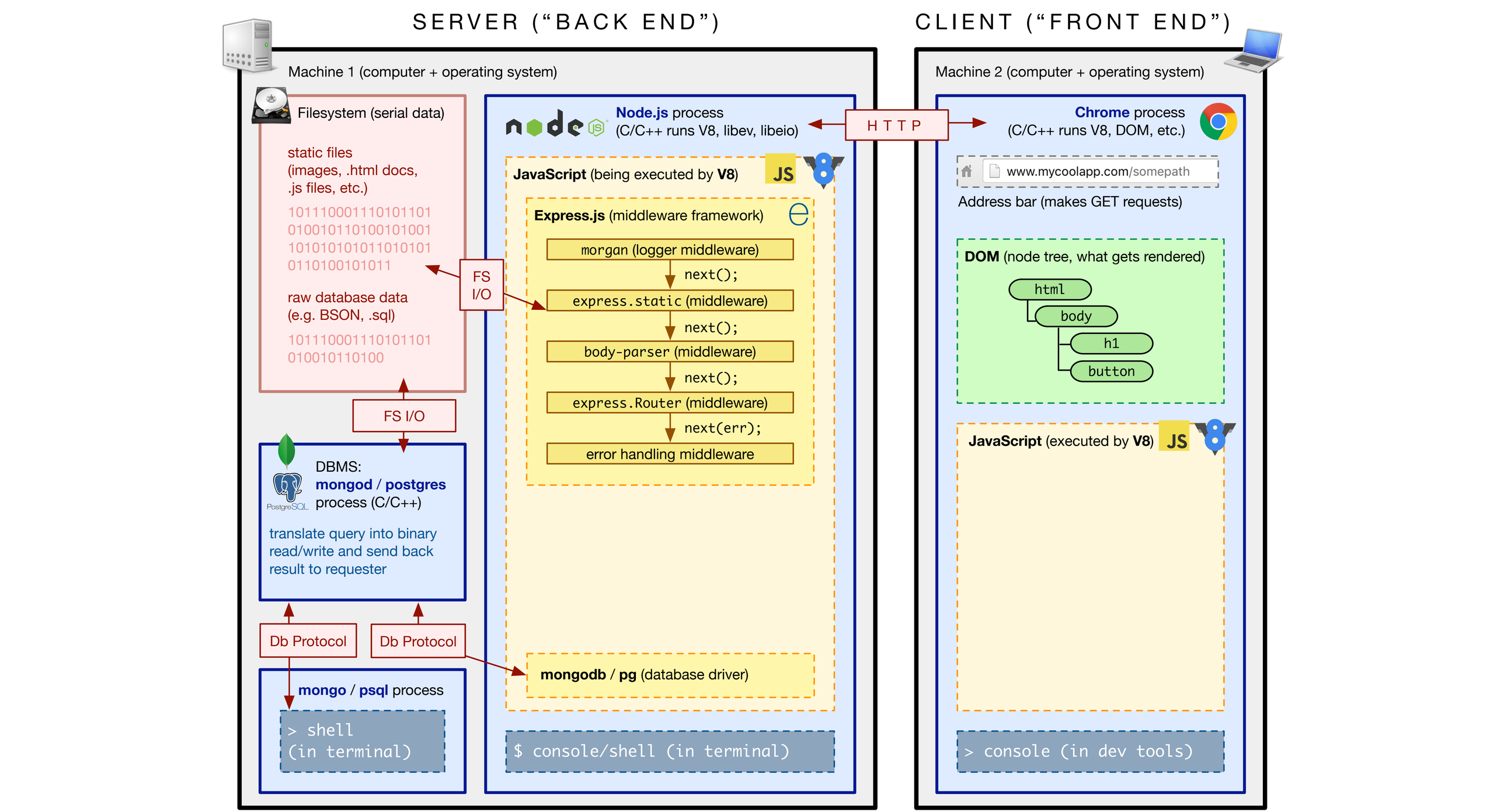
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raw database data
(e.g. BSON, .sql)
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010010110100
FS I/O
FS I/O
DBMS:
mongod / postgres
process (C/C++)
PostgreSQL
translate query into binary
read/write and send back
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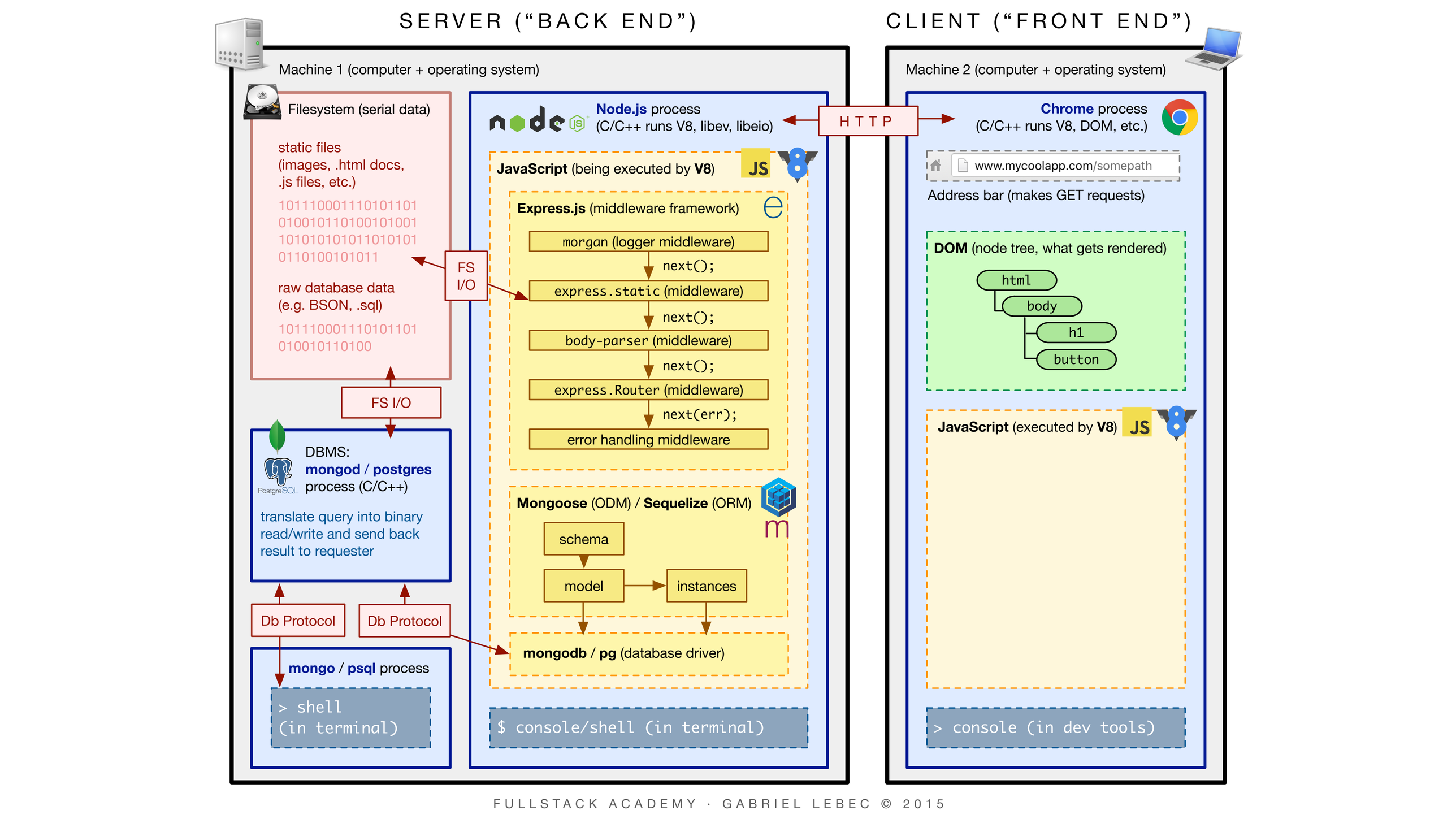
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Wikistack

- Build a Wikipedia clone
- Walk you through installing and using Sequelize
- Application of ***everything*** we've learned so far