- Node.js provides simplicity in development because of its non-blocking I/O and even-based model results in short response time and concurrent processing, unlike other frameworks where developers have to use thread management.

- It runs on a chrome v8 engine which is written in c++ and is highly performant with constant improvement.

- Also since we will use Javascript in both the frontend and backend the development will be much faster.

- And at last, there are ample libraries so that we don't need to reinvent the wheel.

5. Explain the steps how "Control Flow" controls the functions calls?

- Control the order of execution
- Collect data
- Limit concurrency
- Call the following step in the program.

6. What are some commonly used timing features of Node.js?

- **setTimeout/clearTimeout** – This is used to implement delays in code execution.
- **setInterval/clearInterval** – This is used to run a code block multiple times.
- **setImmediate/clearImmediate** – This is used to set the execution of the code at the end of the event loop cycle.
- **process.nextTick** – This is used to set the execution of code at the beginning of the next event loop cycle.

7. What are the advantages of using promises instead of callbacks?

So when an async function needs to be executed(or I/O) the main thread sends it to a different thread allowing v8 to keep executing the main code. Event loop involves different phases with specific tasks such as timers, pending callbacks, idle or prepare, poll, check, close callbacks with different FIFO queues. Also in between iterations it checks for async I/O or timers and shuts down cleanly if there aren't any.

18. If Node.js is single threaded then how does it handle concurrency?

The main loop is single-threaded and all async calls are managed by libuv library.

For example:

```
const crypto = require("crypto");
const start = Date.now();
function logHashTime() {
 crypto.pbkdf2("a", "b", 100000, 512, "sha512", () => {
console.log("Hash: ", Date.now() - start);
 });
}
logHashTime();
logHashTime();
logHashTime();
logHashTime();
```

This gives the output:

```
Hash: 1213
Hash: 1225
Hash: 1212
Hash: 1222
```

This is because libuv sets up a thread pool to handle such concurrency. How many threads will be there in the thread pool depends upon the number of cores but you can override this.

19. Differentiate between process.nextTick() and setImmediate()?

28. Describe the exit codes of Node.js?

Exit codes give us an idea of how a process got terminated/the reason behind termination.

A few of them are:

- Uncaught fatal exception - (code - 1) - There has been an exception that is not handled
- Unused - (code - 2) - This is reserved by bash
- Fatal Error - (code - 5) - There has been an error in V8 with stderr output of the description
- Internal Exception handler Run-time failure - (code - 7) - There has been an exception when bootstrapping function was called
- Internal JavaScript Evaluation Failure - (code - 4) - There has been an exception when the bootstrapping process failed to return function value when evaluated.

29. Explain the concept of stub in Node.js?

Stubs are used in writing tests which are an important part of development. It replaces the whole function which is getting tested.

This helps in scenarios where we need to test:

- External calls which make tests slow and difficult to write (e.g HTTP calls/ DB calls)
- Triggering different outcomes for a piece of code (e.g. what happens if an error is thrown/ if it passes)

For example, this is the function:

Web assembly provides an implementation of WebAssembly System Interface specification through WASI API in node.js implemented using WASI class. The introduction of WASI was done by keeping in mind its possible to use the underlying operating system via a collection of POSIX-like functions thus further enabling the application to use resources more efficiently and features that require system-level access.

34. How are worker threads different from clusters?

Cluster:

- There is one process on each CPU with an IPC to communicate.
- In case we want to have multiple servers accepting HTTP requests via a single port, clusters can be helpful.
- The processes are spawned in each CPU thus will have separate memory and node instance which further will lead to memory issues.

Worker threads:

- There is only one process in total with multiple threads.
- Each thread has one Node instance (one event loop, one JS engine) with most of the APIs accessible.
- Shares memory with other threads (e.g. SharedArrayBuffer)
- This can be used for CPU-intensive tasks like processing data or accessing the file system since NodeJS is single-threaded, synchronous tasks can be made more efficient leveraging the worker's threads.

35. How to measure the duration of async operations?

Performance API provides us with tools to figure out the necessary performance metrics. A simple example would be using async_hooks and perf_hooks

Both can be used to switch to an asynchronous mode of operation by listener functions.

process.nextTick() sets the callback to execute but setImmediate pushes the callback in the queue to be executed. So the event loop runs in the following manner

timers–>pending callbacks–>idle,prepare–>connections(poll,data,etc)–>check–>close callbacks

In this process.nextTick() method adds the callback function to the start of the next event queue and setImmediate() method to place the function in the check phase of the next event queue.

20. How does Node.js overcome the problem of blocking of I/O operations?

Since the node has an event loop that can be used to handle all the I/O operations in an asynchronous manner without blocking the main function.

So for example, if some network call needs to happen it will be scheduled in the event loop instead of the main thread(single thread). And if there are multiple such I/O calls each one will be queued accordingly to be executed separately(other than the main thread).

Thus even though we have single-threaded JS, I/O ops are handled in a nonblocking way.

21. How can we use async await in node.js?

Here is an example of using async-await pattern: