Node.js: What, Why and How?

Michael Dawson
IBM Community Lead for Node.js

POWERUp18 Session ID: 180232

Agenda Key: 32CF

About Michael Dawson
IBM Community Lead for Node.js

- Active Node.js community member
  - Collaborator
  - Node.js Technical Steering Committee TSC Chair
  - Community Committee member
  - Working group(s) member/leadership

- Twitter: @mhdawson1
- GitHub: @mhdawson
- Linkedin: https://www.linkedin.com/in/michael-dawson-6051282

Agenda

- Why Node.js ?
- Node.js deep dive
- Positioning versus Java™
- Node.js community
- IBM involvement

Why Node.js ?

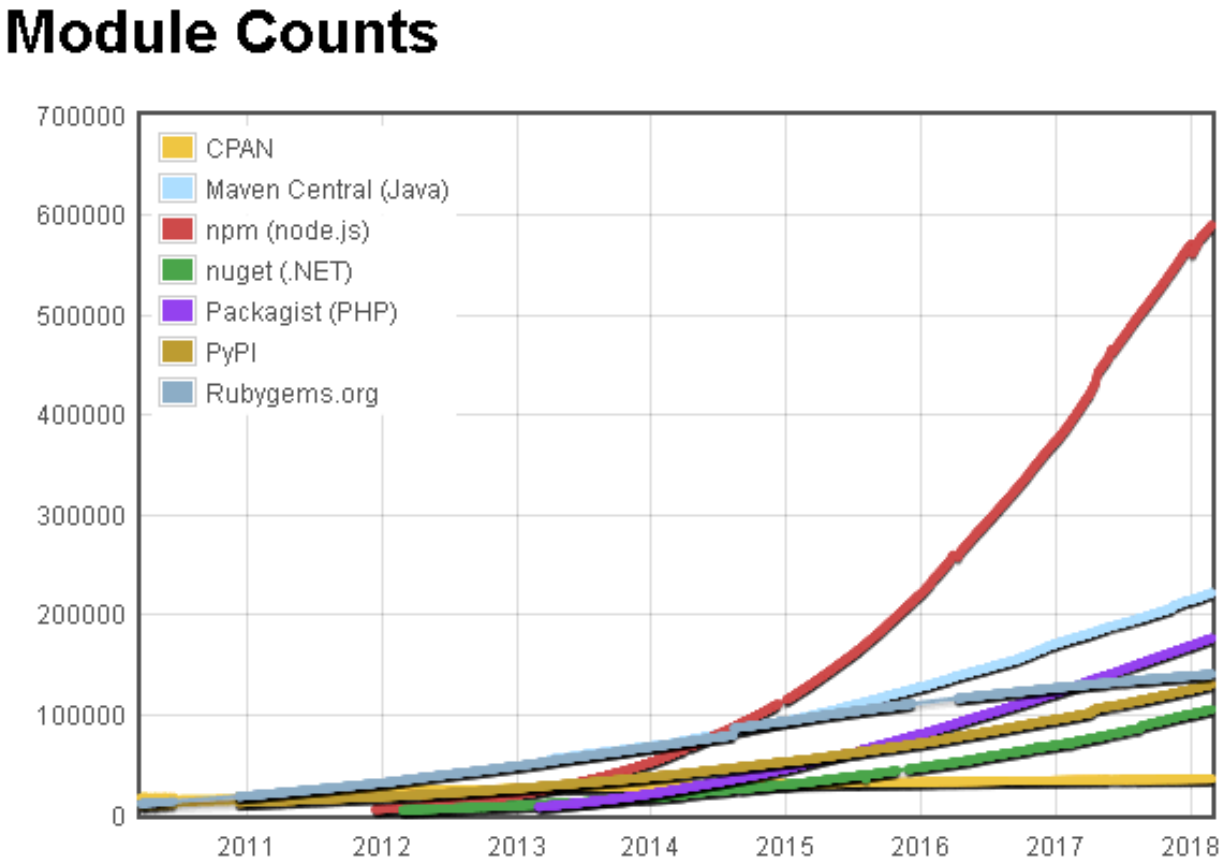
- What is it ?
- Ecosystem
- Productivity
- Performance

Why Node.js – What is it?

- JavaScript != Java
- Node.js = **Server-side** JavaScript
  - Event-oriented
  - Non-blocking
  - Asynchronous

Why Node.js ? – Ecosystem

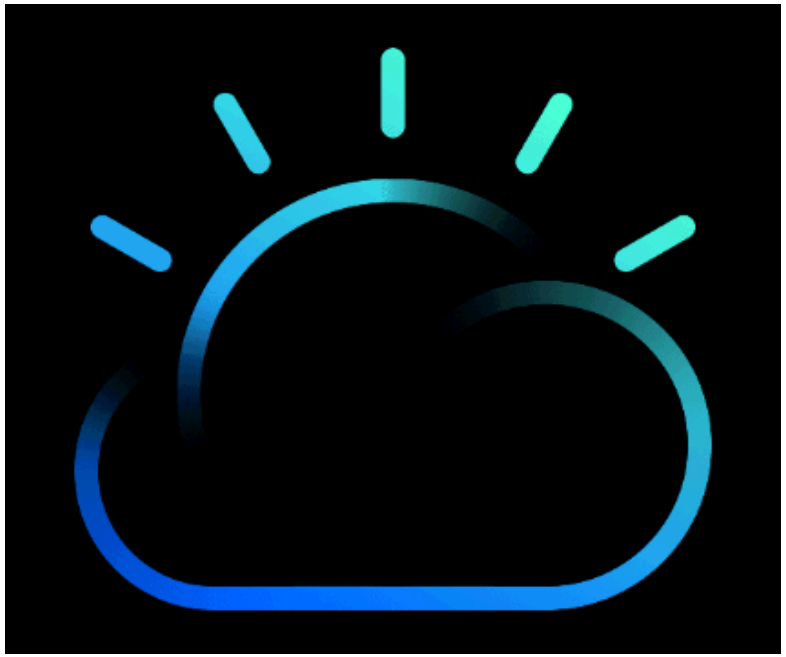
- There is a module for that
  - 600K modules
  - #1 on module counts
- #1 on Github (#projects)



http://www.modulecounts.com/

Why Node.js ? – Ecosystem

- Most used runtime in IBM Cloud



Infrastructure

Containers

Get started by creating a Kubernetes cluster, or manage your Docker images in the registry.

Containers in Kubernetes Clusters

Deploy secure, highly available apps in a

IBM

Cloud Foundry Apps

Deploy your app without managing underlying infrastructure.

SDK for Node.js™

Develop, deploy, and scale server-side

IBM

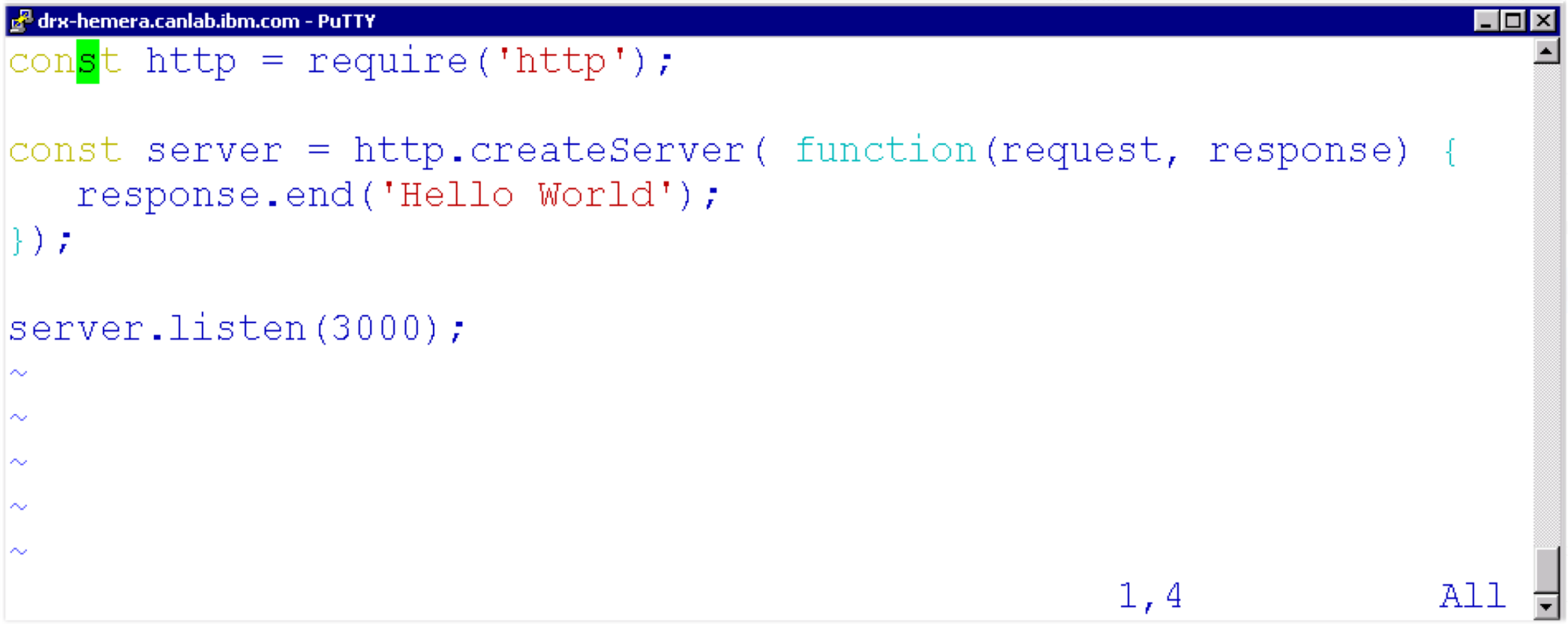
Why Node.js ? – Productivity

- **Faster** development **less code**
- **PayPal** - https://www.paypal-engineering.com/2013/11/22/node-js-at-paypal/
  - **Took 1/2 time with less people**
  - **33% fewer lines of code**
- **NextFlix** - http://www.infoworld.com/article/2610110/javascript/paypal-and-netflix-cozy-up-to-node-js.html

Why Node.js ? – Productivity

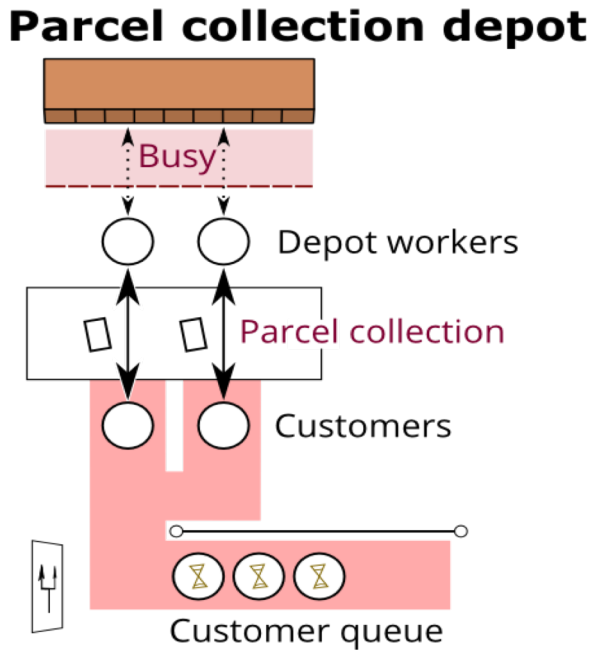
- Reuse of “isomorphic” code components
- Availability of JavaScript talent
- Developer satisfaction

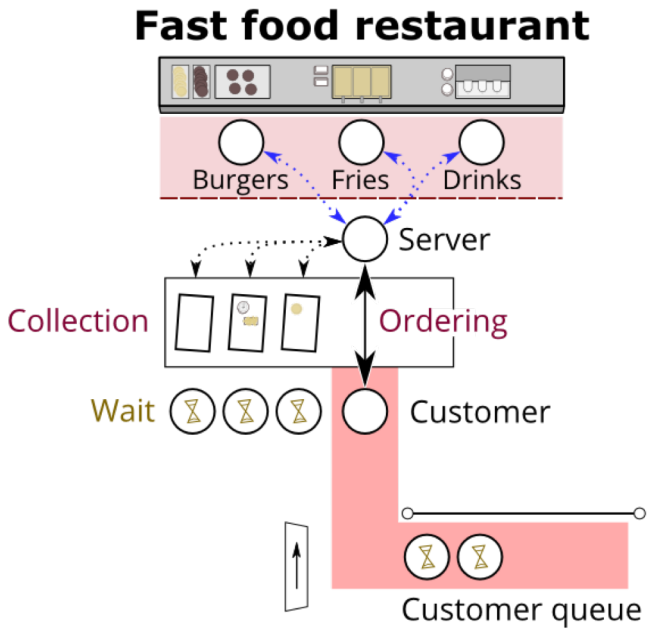
Why Node.js ? – Productivity



Why Node.js ? - Performance

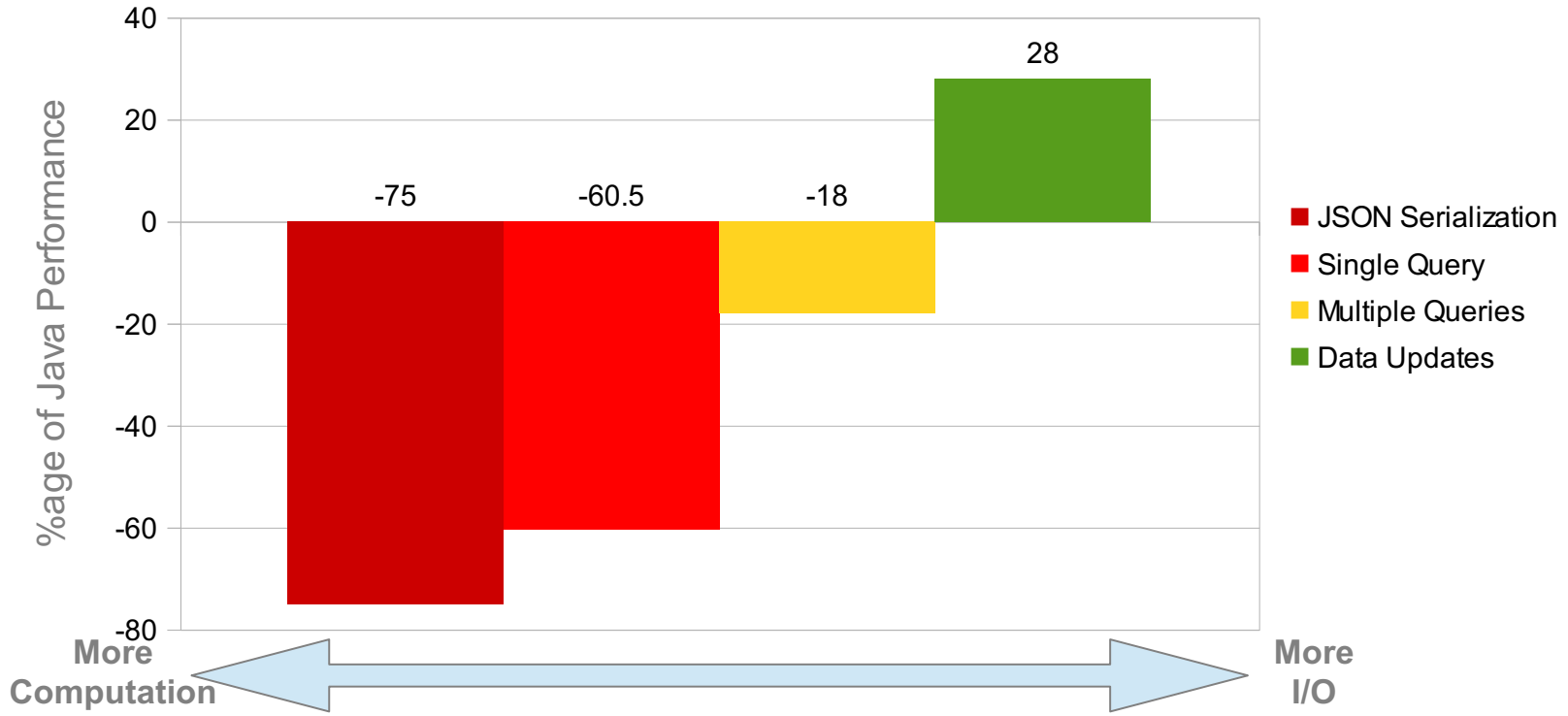
Event based: perfect fit for asynchronous non-blocking I/0





Why Node.js ? - Performance

Best suited for asynchronous workloads



Why Node.js ? - Performance

- Thousands of concurrent connections

- PayPal - https://www.paypal-engineering.com/2013/11/22/node-js-at-paypal/
  - **Double** number of requests/sec
  - Response times 35% **lower**

- Groupon – http://www.nearform.com/nodecrunch/node-js-becoming-go-technology-enterprise/
  - Reduced page load times by 50%

Node.js – Deep Dive

- Key characteristics
- Components
- Programing model
- Event loop
- Native code
- Common use cases

Node.js – Deep Dive – Key Characteristics

- Small (linux.tar.xz)
  - Download **10.8 MB**
  - Uncompressed **69 MB**

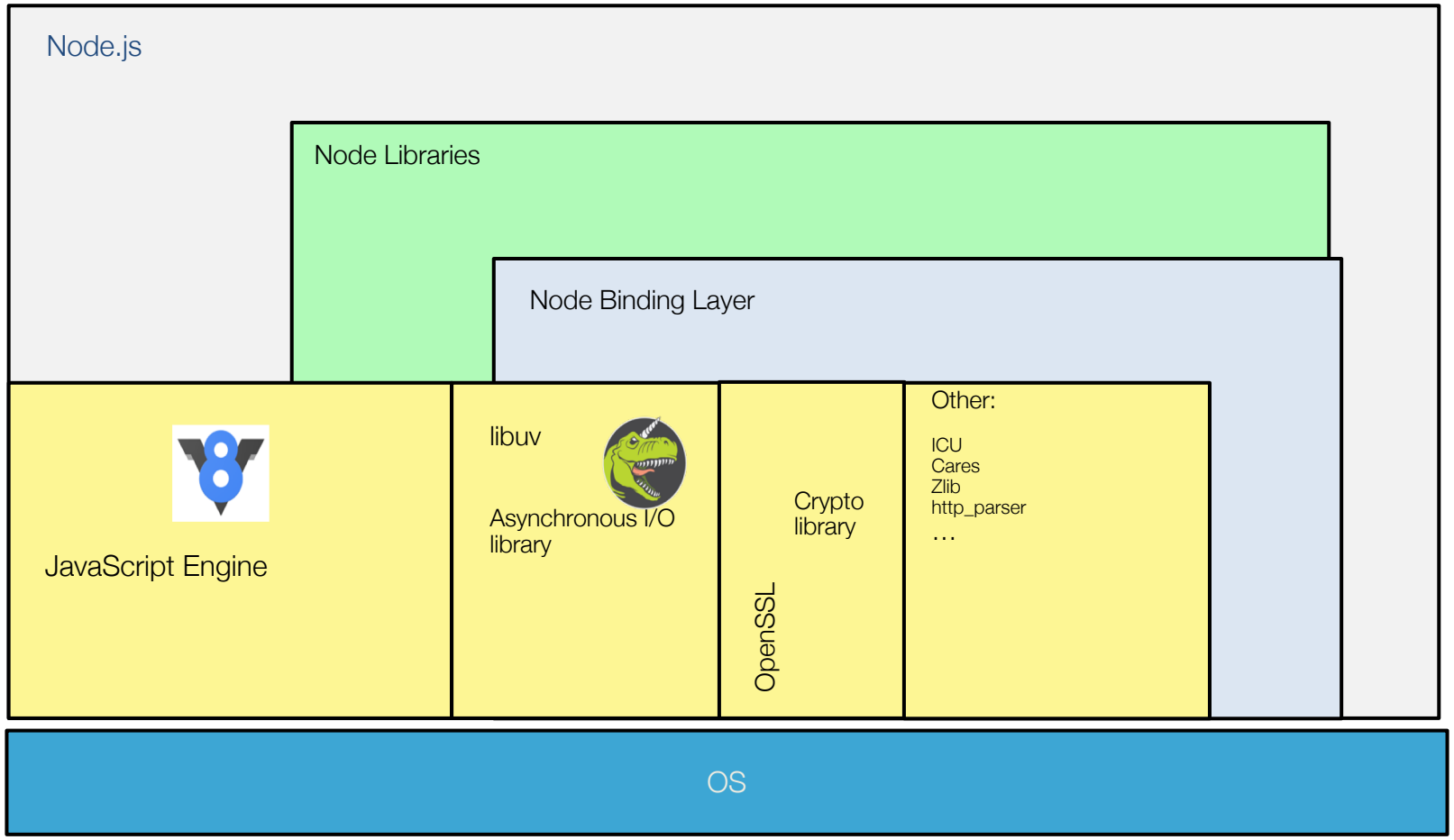
https://nodejs.org/en/download/

- Fast startup
  - 60 ms

https://benchmarking.nodejs.org/

- Small footprint
  - 18 MB

Node.js – Deep Dive - Components



C/C++ Compiler

Node.js – Deep Dive - Programming Model

- Dynamic
- Functional
- Asynchronous
- Event Based

drx-hemera.canlab.ibm.com - PuTTY

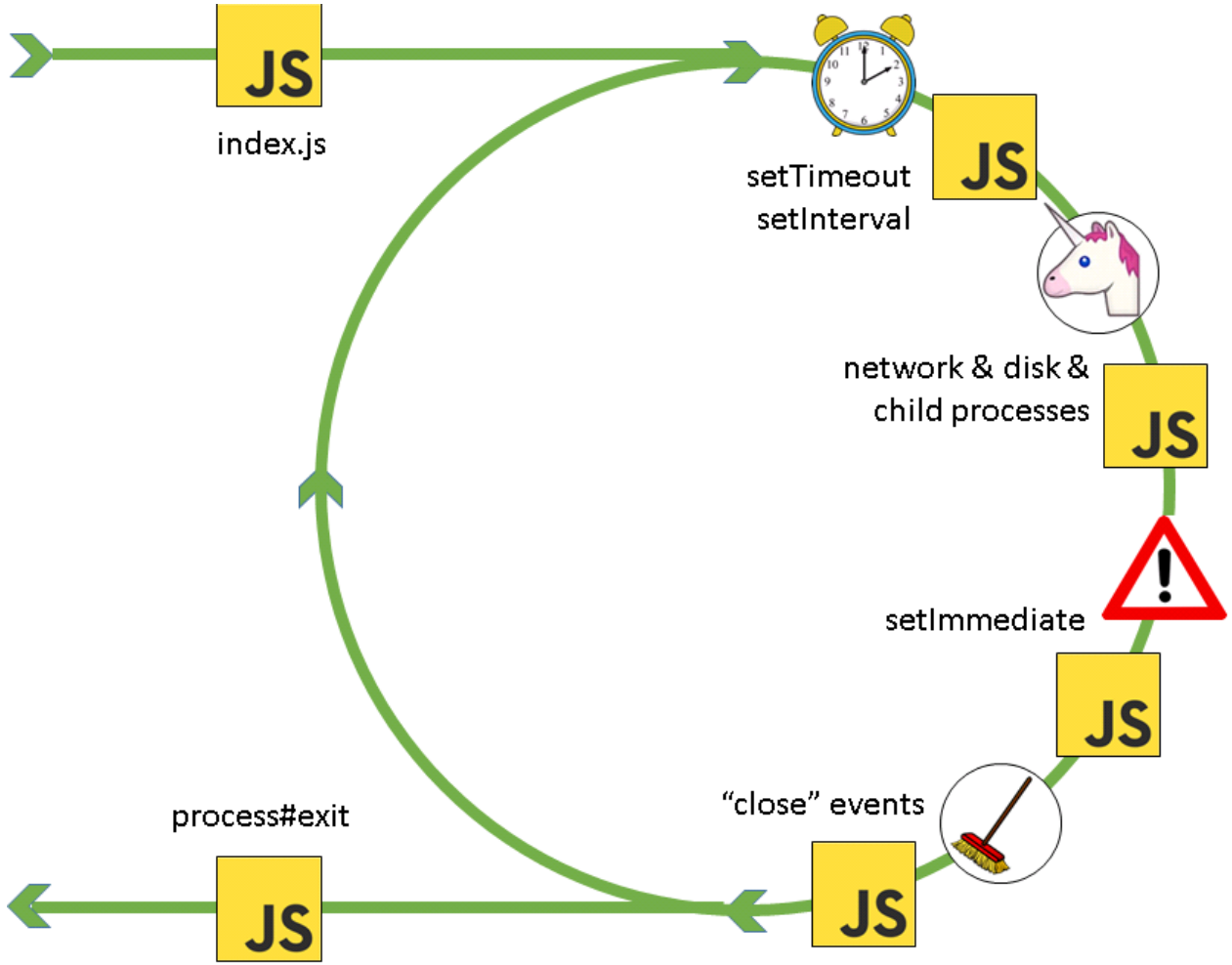
```
-sh-4.2$ cat sample.js

var data = 50;

var myNiftyFunction = function(param, callback) {
  setImmediate(callback.bind(null, param));
}

myNiftyFunction(1000, function(result) {
  console.log('In function:' + (result + data));
});

data = data + 1000000;
console.log('Mainline:' + data);
-sh-4.2$
-sh-4.2$ ./node sample.js
Mainline:1000050
In function:1001050
-sh-4.2$
```

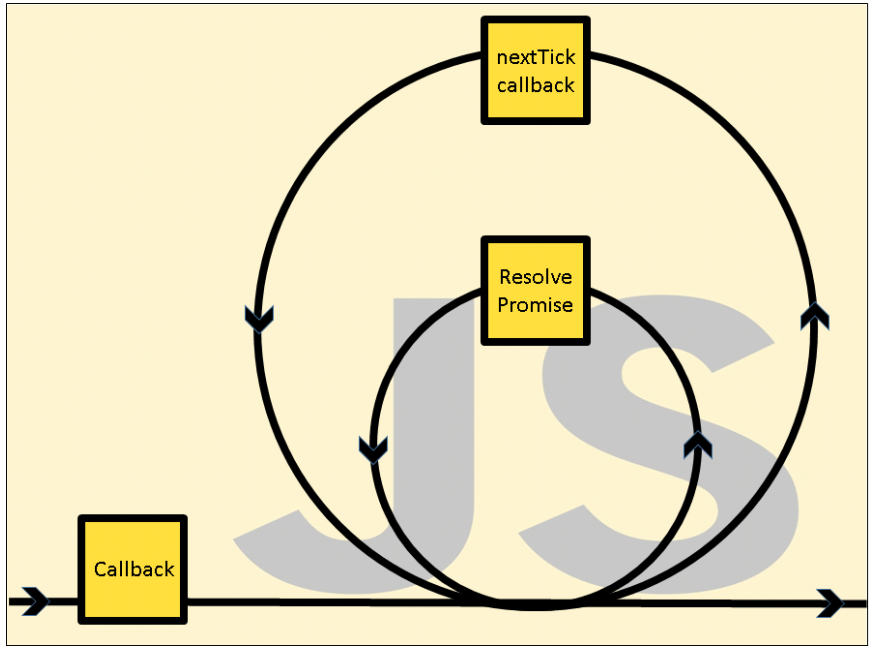
Node.js – Deep Dive - Programming Model

- Event Based

```
var http = require('http');

var server = http.createServer();
server.listen(8080);

server.on('request', function(request, response) {
                response.writeHead(200, {"Content-Type": "text/plain"});
                response.write("Hello World!\n");
                response.end();
});

server.on('connection', function(socket) {});
server.on('close', function() {});
server.on('connect', function(socket) {});
server.on('upgrade', function(request, socket, head) {});
server.on('clientError', function(exception, socket) {});
```

Node.js – Deep Dive – Event Loop





Node.js – Deep Dive – Native Code

```
#include <node.h>

void nativeMethod(const FunctionCallbackInfo<Value> & args) {
  Isolate* is = args.GetIsolate();
  args.GetReturnValue().Set(String::NewFromUtf8(is, "Hi from native"));
}

void init(Local<Object> exports) {
  NODE_SET_METHOD(exports, "callNative", nativeMethod);
}

NODE_MODULE(nativeModule, init);
```

https://nodejs.org/api/addons.html

Node.js – Deep Dive – Native Code

```
const nativeModule = require('./build/Release/nativeModule');

console.log(nativeModule.callNative());
```

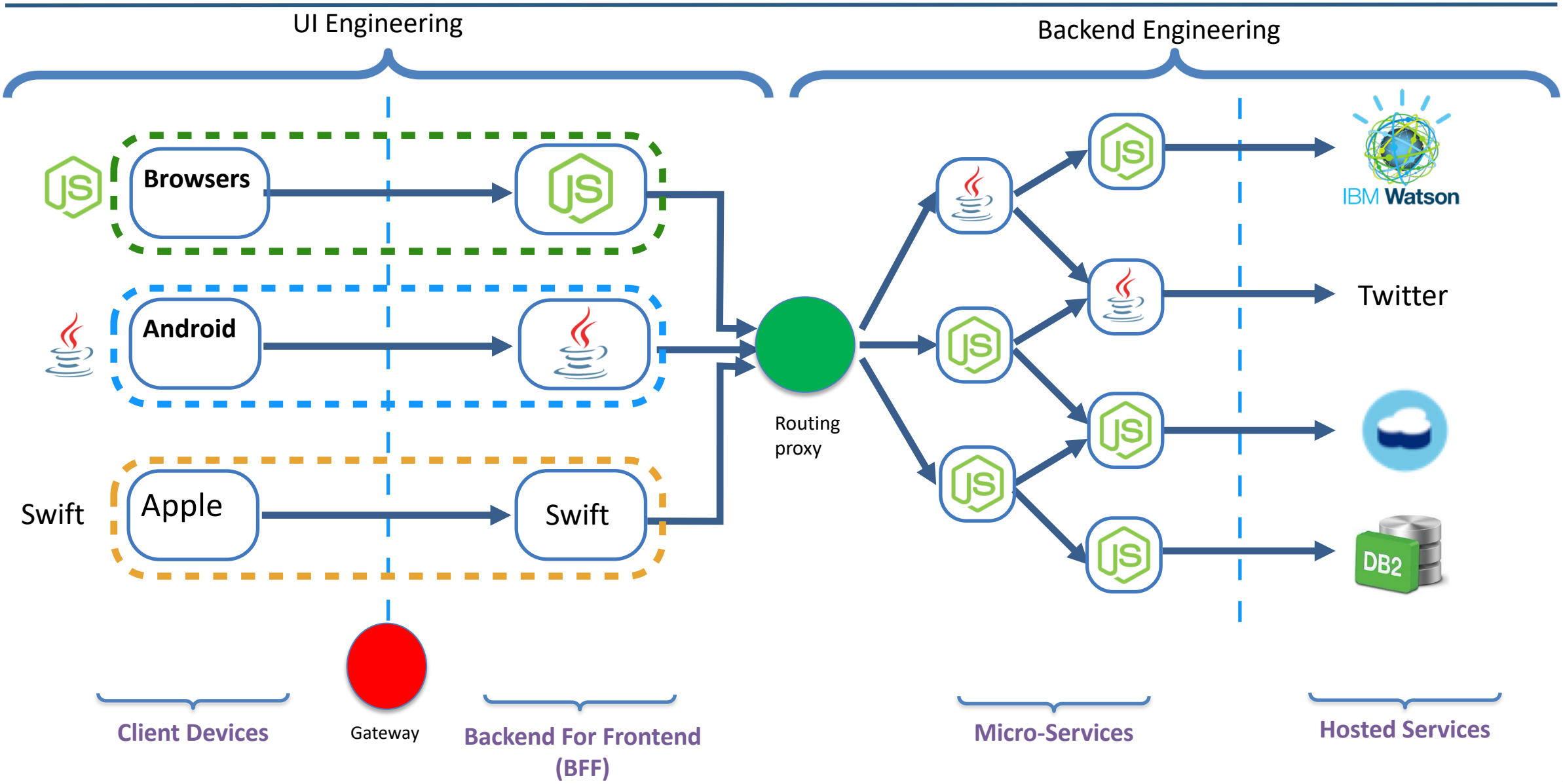
https://nodejs.org/api/addons.html

Node.js – Deep Dive – Use Cases

https://github.com/nodejs/benchmarking/blob/master/docs/use_cases.md

- Back-end API services
- Service oriented architectures (SOA)
- Microservice-based applications
- Generating/serving dynamic web page content
- SPA applications with bidirectional communication over WebSockets and/or HTTP/2
- Agents and data collectors
- Small scripts

Node.js With Java

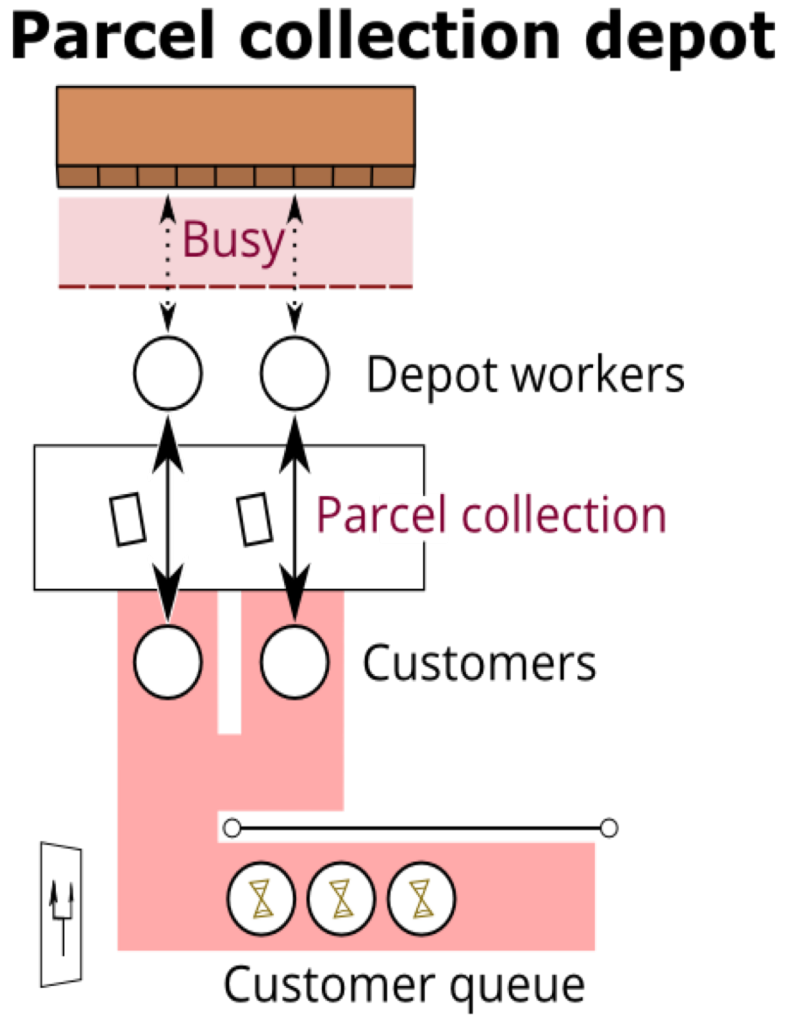


Node.js With Java

- Strengths and weaknesses
- Choosing the right language
- Hybrid applications

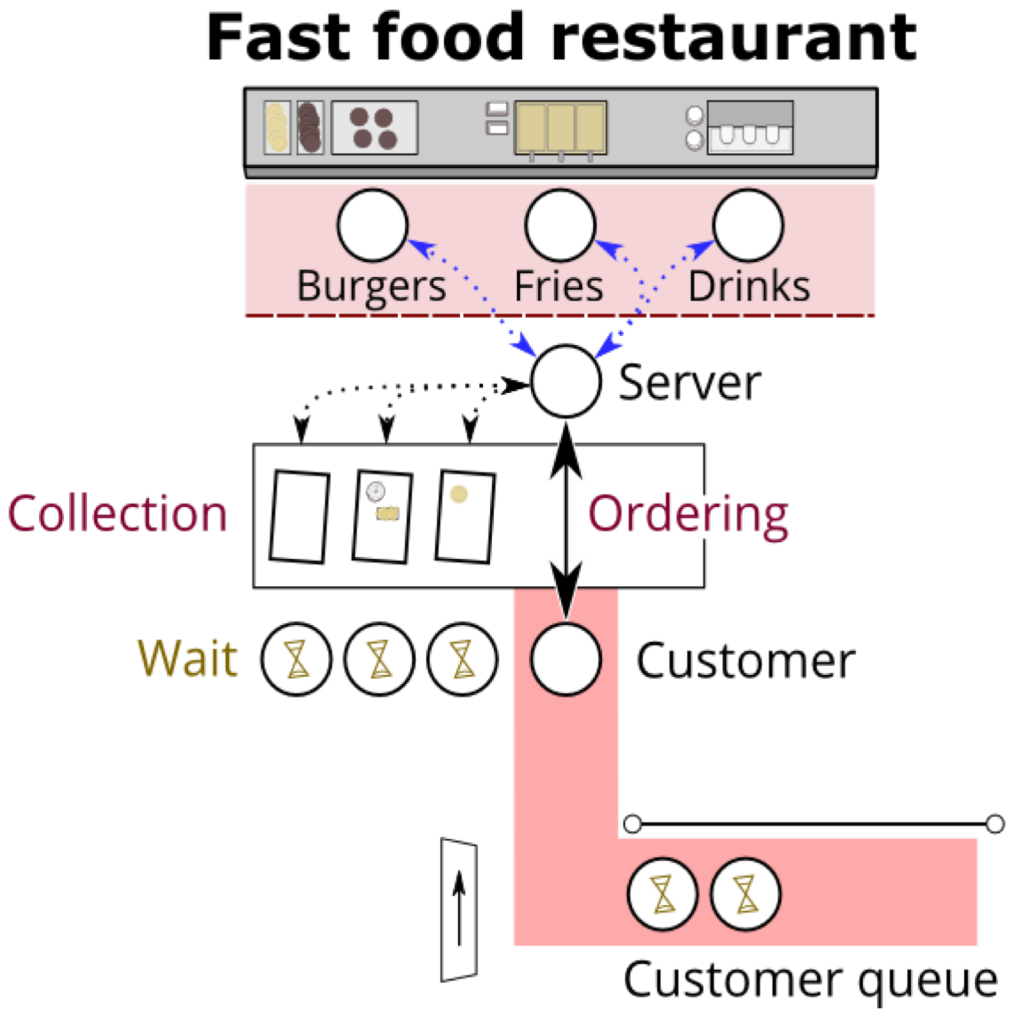
Node.js With Java – Scaling with Java

- One thread (or process) per connection
  - Each thread waits on a response
  - Scalability determined by number of threads
- Each thread:
  - Consumes memory
  - Is relatively idle
- Concurrency determined by number of depot workers

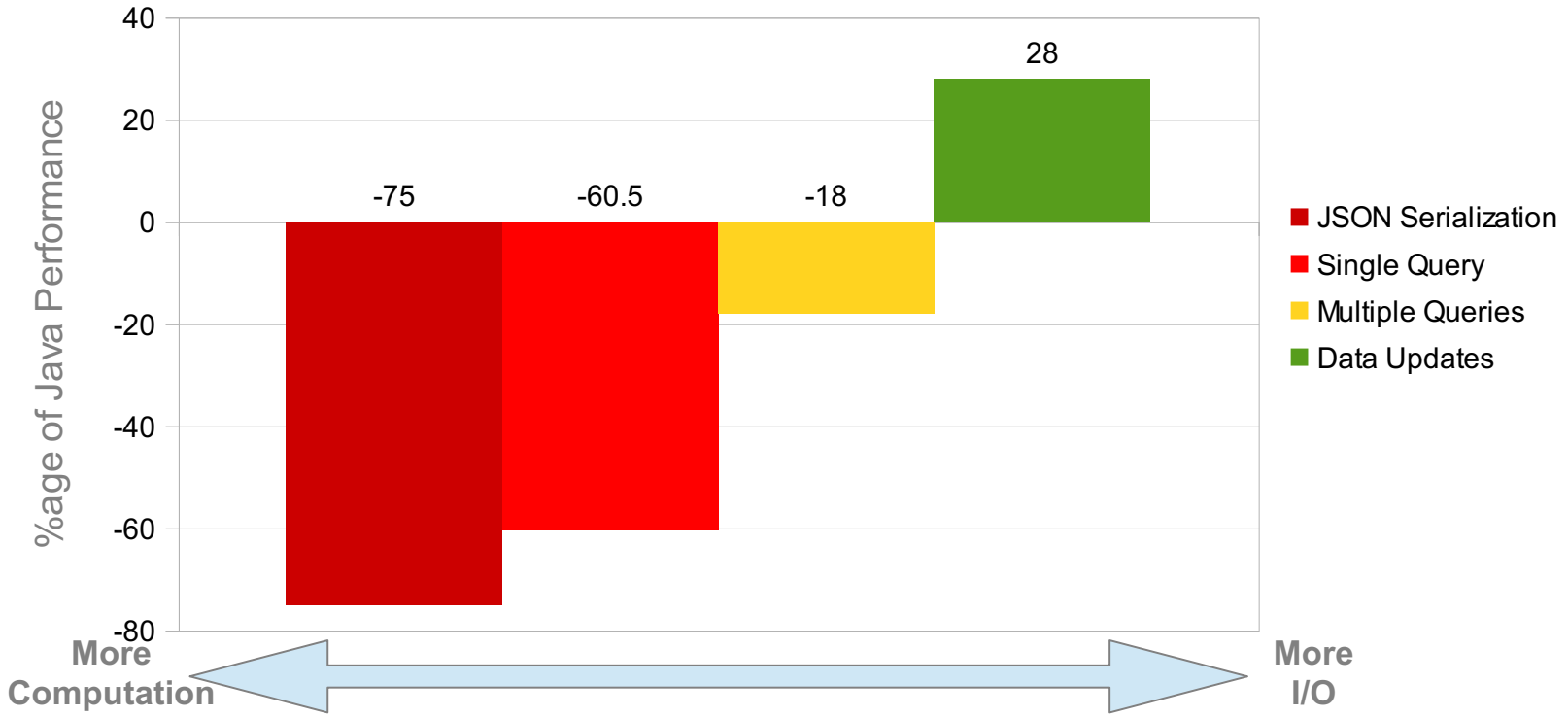


Node.js versus Java – Scaling with Node.js

- One thread multiplexes for multiple requests
  - No waiting for a response
  - Handles return from I/O when notified
- Scalability determined by:
  - CPU Usage
  - “Back end” responsiveness
- Concurrency determined by how fast the food server can work



Node.js With Java– Tradeoffs



Node.js With Java – Choosing the Right Language

- Higher performance for I/O
- Easier async programming
- Fullstack/isomorphic development

Node.js versus Java – Choosing the Right Language

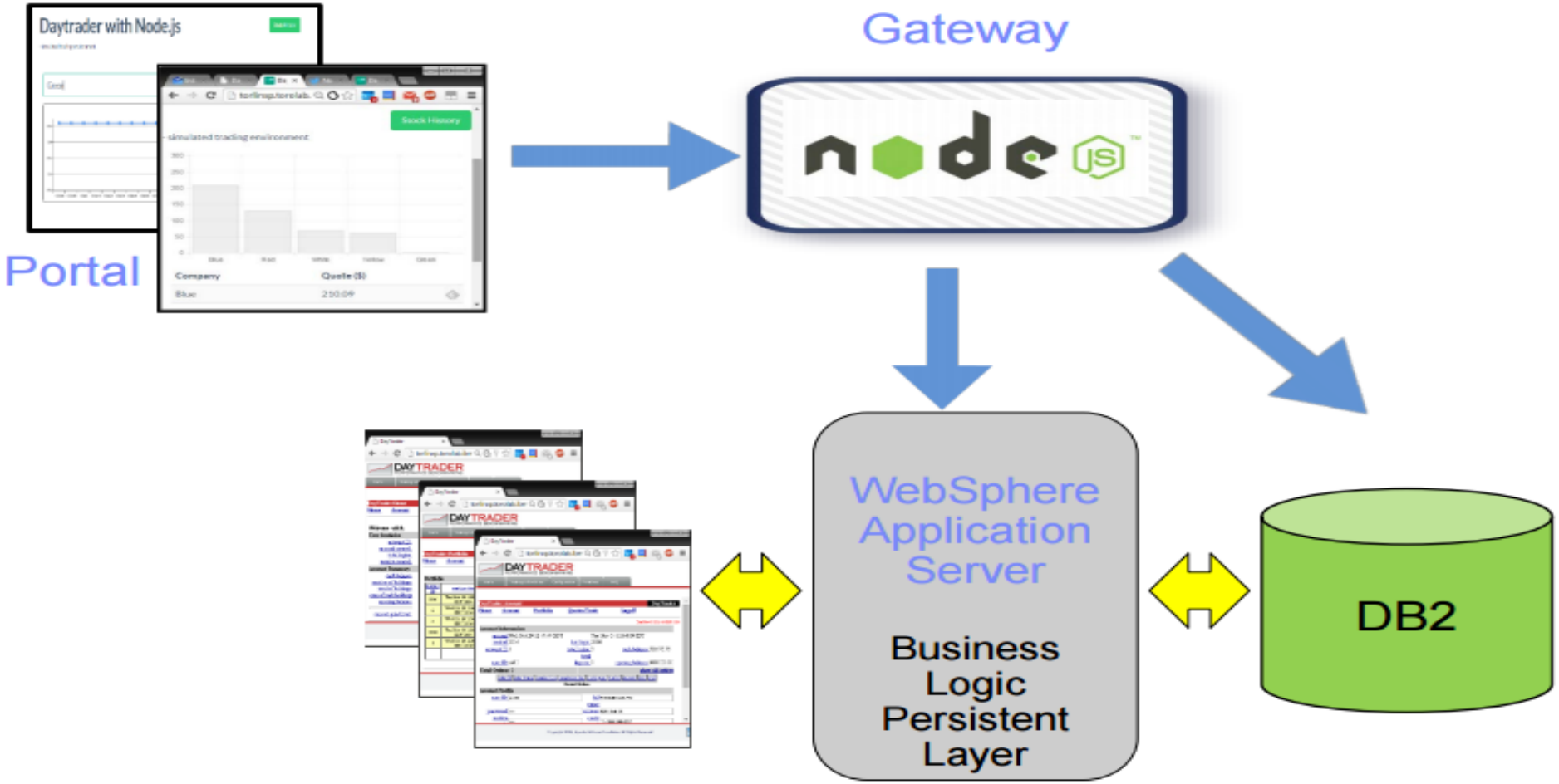
- Higher processing performance
- Type safety for calculations
- Rich processing frameworks

Node.js With Java– Choosing the Right Language

+

- Highly performant, scalable rich web applications
- Highly performant, reliable transaction processing
- Self-contained micro-service components

Node.js With Java– Hybrid applications



Node.js Community

- History
- Foundation
- Day to Day

Node.js Community - History

- **2009 – written by Ryan Dhal**
- **Jan 2010 - npm**
- **Sep 2010 – Joyent sponsors Node.js**
- **June 2011 – Windows support**
- **2012 – 2014 – Hand over to Isaac Schlueter, then Timothy J. Fontaine**
- **December 2014 – io.js fork**
- **June 2015 – Node.js Foundation**
- **Oct 2015 – Node.js 4.x unites io.js/node.js 0.12.x lines**
- **Oct 2016 – Node.js 6.x**
- **Oct 2017 – Node.js 8.X**
- **Oct 2018 ….**

Node.js Community - Foundation

- Mission:

The Node.js Foundation's mission is to enable widespread adoption and help accelerate development of Node.js and other related modules through an open governance model that encourages participation, technical contribution, and a framework for long term stewardship by an ecosystem invested in Node.js' success.

https://nodejs.org/en/foundation/

- Corporate members
  - 5 platinum(including IBM), 3 gold, 19 Silver
- Individual members

Node.js Community – Day to Day

- TSC - Technical Steering Committee https://github.com/nodejs/TSC/
  - Collaborators (100+) https://github.com/nodejs/node/
  - Working Groups (Build, LTS, Benchmarking, API etc.) https://github.com/nodejs/node/blob/master/WORKING_GROUPS.md
  - Teams https://github.com/orgs/nodejs/teams
- Community Committee
  - Teams (ex user-feedback)
  - Working Groups (to come)

The Challenge for Every Existing Enterprise:

How to make the old work with the new?

Traditional IT

On Prem

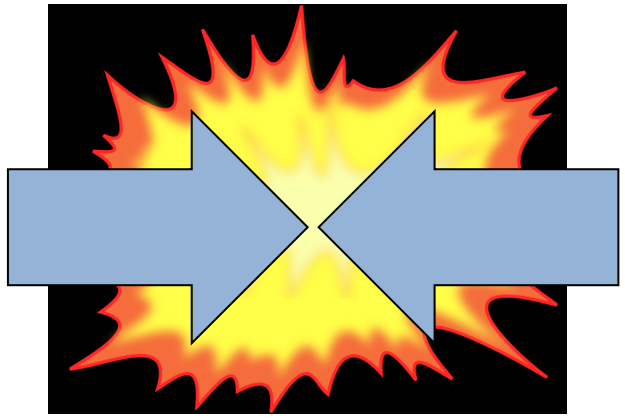
Packaged Apps

SOA / Monolithic

Relational DB

Waterfall

Java / .NET / C# / Other



New IT

Cloud

SaaS

Microservices / APIs

Relational & Non-Relational

DevOps

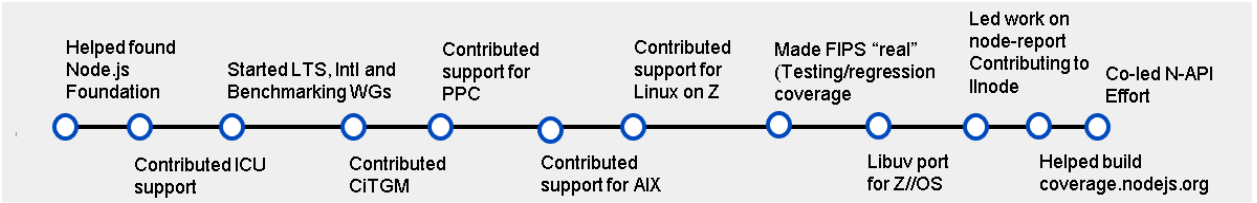
Node / SWIFT / Other

IBM Node.js Strategy

- Enterprise Ready Runtime
- Production Enablement
- Production Support

Enterprise Ready Runtime

- Embrace and Improve Community Runtime
  - Engage and lead
  - Develop expertise and influence
  - Platinum member of Node.js Foundation
- Enterprise Focus
  - Stable and Predictable releases
  - Platform support
  - Security
  - Diagnostics
  - Performance
  - Code quality and safety net
  - Key Features

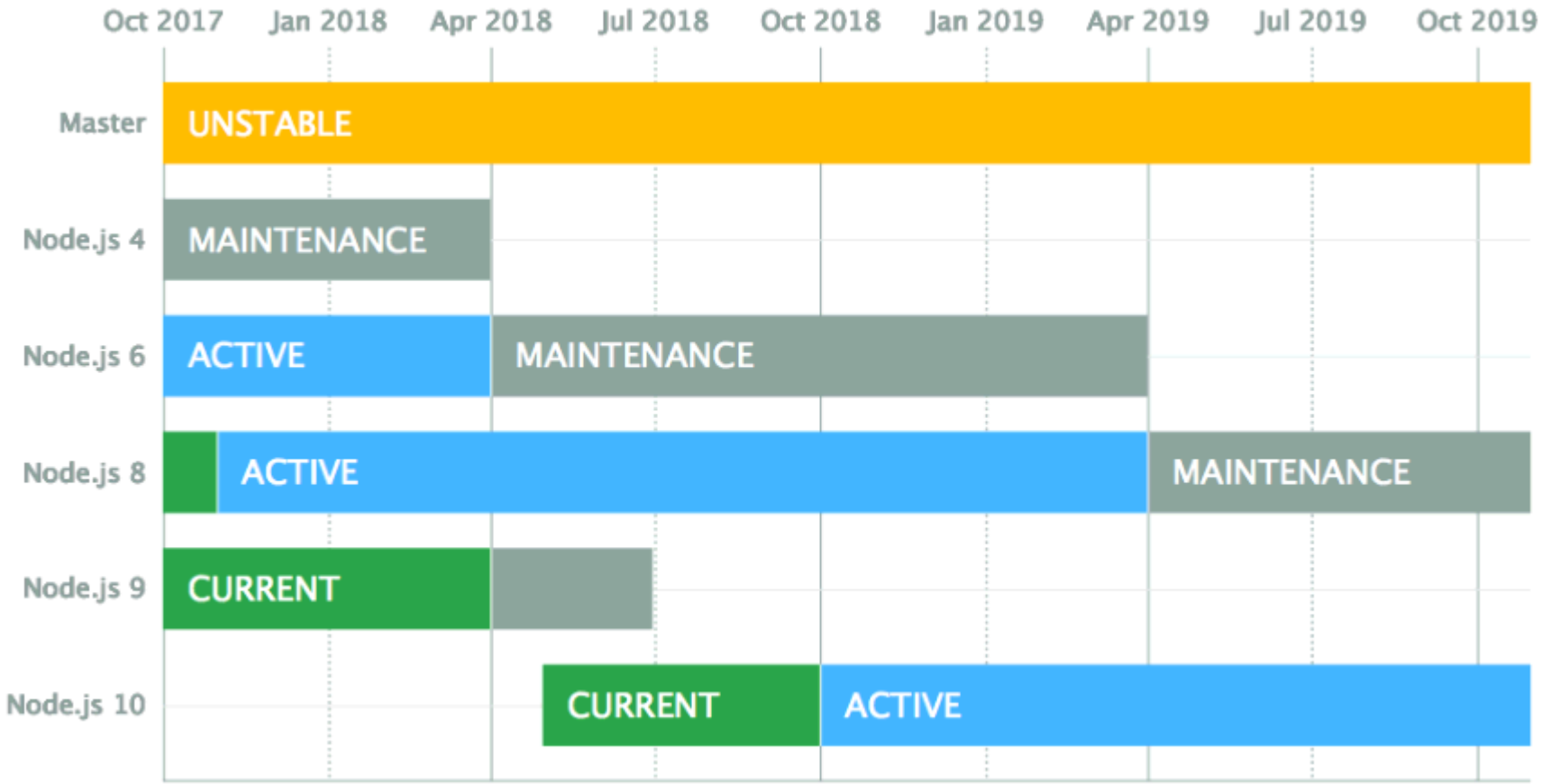


Stable and Predictable Releases

- Bleeding Edge
  - Canary
  - Nightlies
- Current
  - Every 6 months
  - Even releases promoted to LTS
- LTS
  - Every 12 months
  - 30 Months support (18 active, 12 maintenance)

Stable and Predictable Releases - Schedule for 2018

https://github.com/nodejs/Release



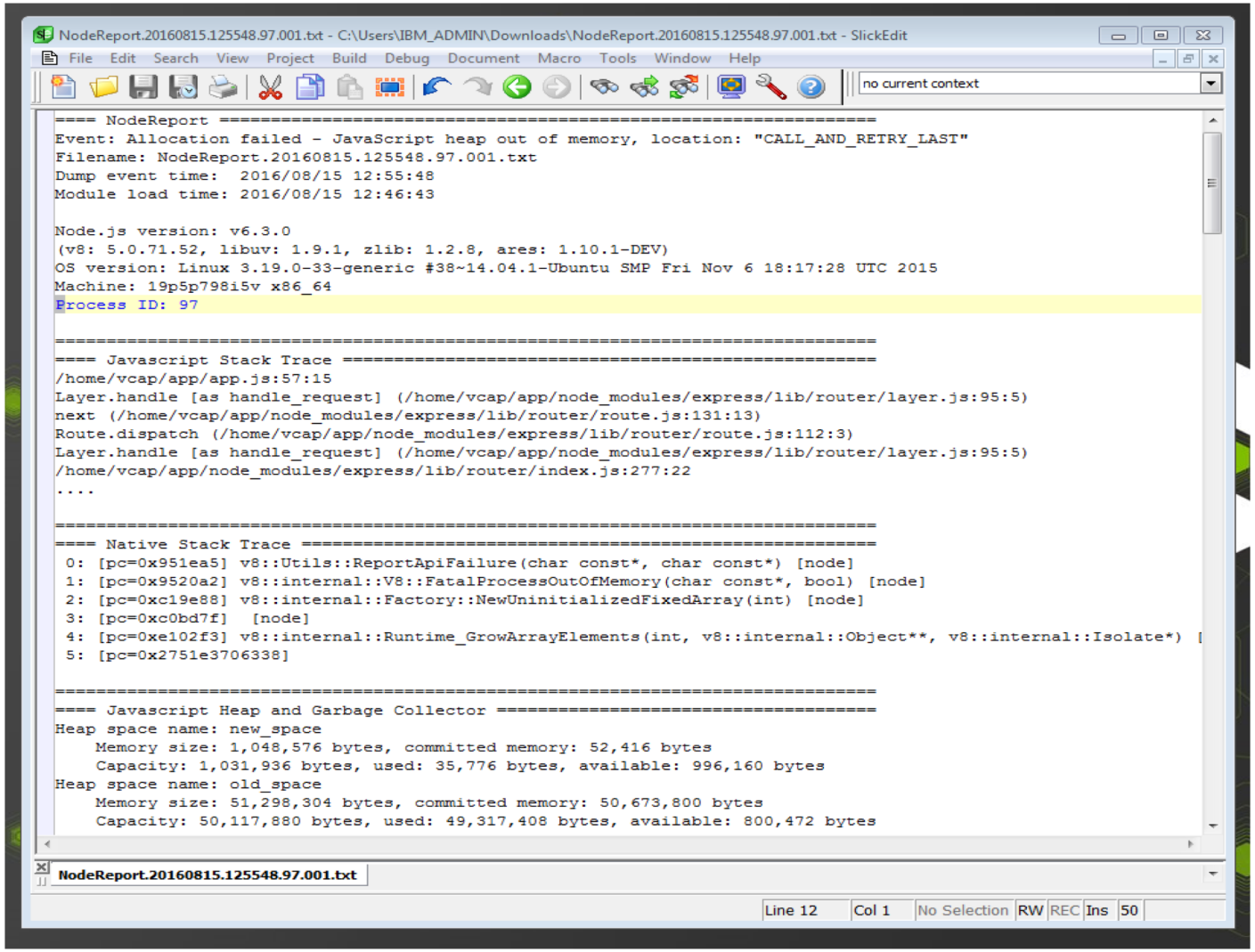
Node.js IBM – Tooling - NodeReport

NodeReport example - heap out of memory error

NodeReport content:

- Event summary
- Node.js and OS versions
- JavaScript stack trace
- Native stack trace
- Heap and GC statistics
- Resource usage
- libuv handle summary
- Environment variables
- OS ulimit settings

https://github.com/nodejs/nodereport



IBM Node.js Community Leadership

Participation in Technical Steering Committee

Michael
Dawson

IBM Node.js Community Leadership

9 Core Collaborators

Michel **Dawson**

Ben **Noordhuis**

Gireesh **Punathil**

Bethany Griggs

Yi-Hong Wang

Sam **Roberts**

Steven **Loomis**

Richard **Lau**

Ryan **Graham**

Node.js IBM – V8 Community Involvement

- Deep expertise at V8
- Developed ports to IBM Platforms
- Contribution back to official V8 repositories: https://github.com/v8/v8
  - **PPC**: V8 4.3 and later have full functional PPC implementation
  - **s390**: V8 5.1 and later have full functional implementatio1n
  - ~10-15 commits per week to V8 to maintain PPC/zlinux port
- Internal port for z/OS and IBM i

Production Enablement

- First Class Cloud Deployment Options

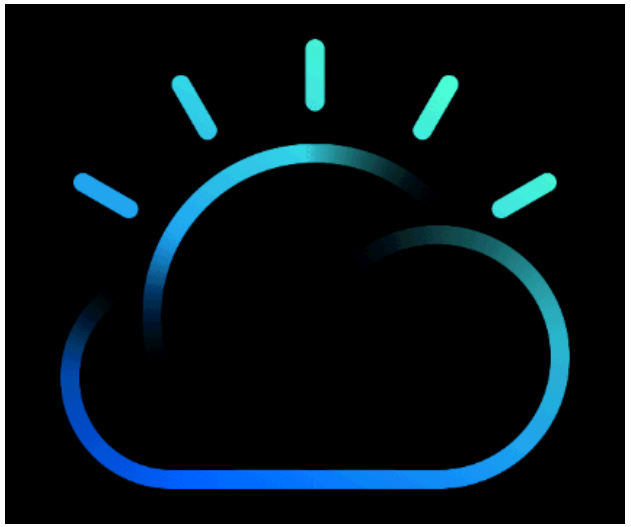
- Freedom of Platform Choice

- Leverage existing Data assets

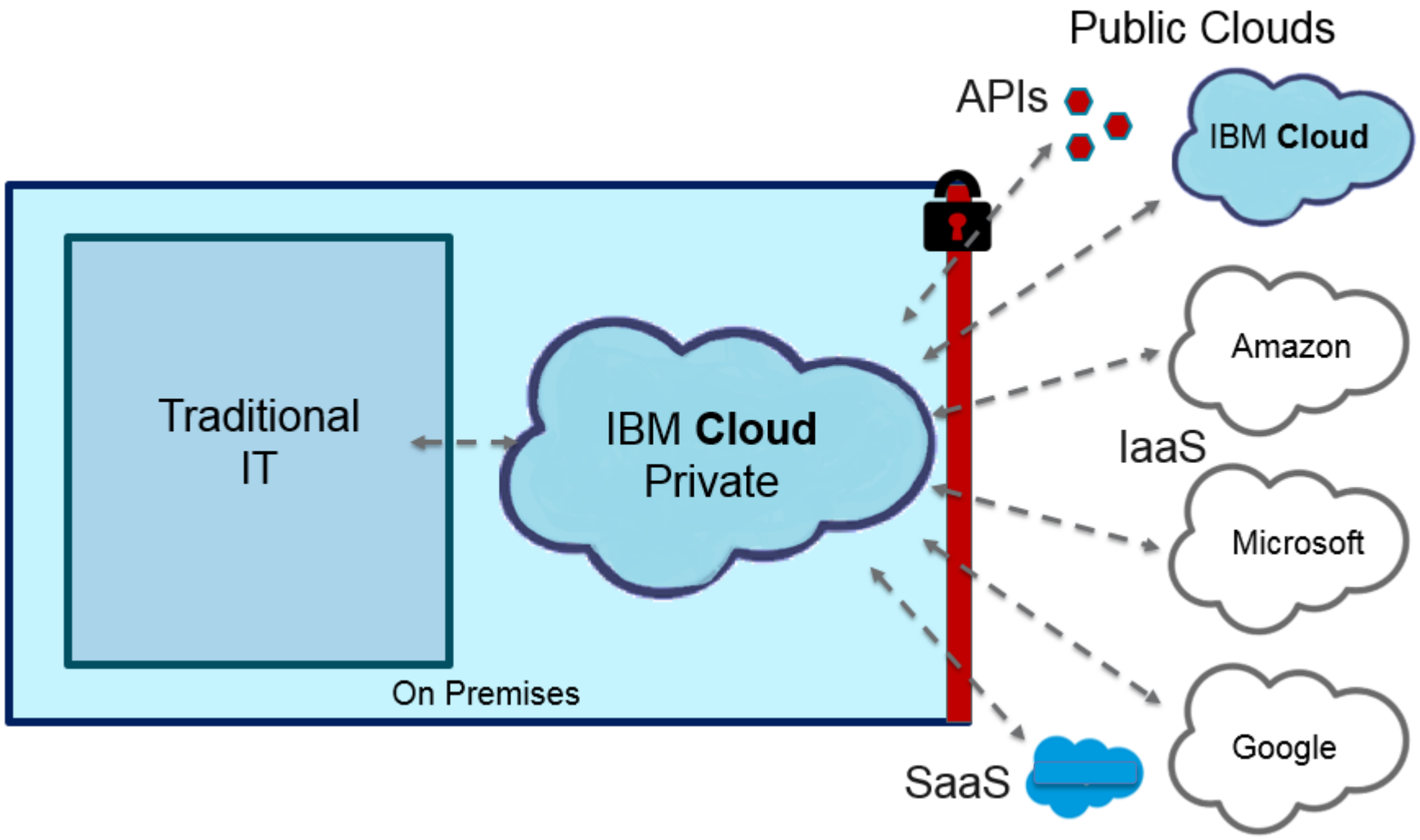
- Tools to Accelerate Development/Deployment

First Class Cloud Deployment Options

- Public/Private/Hybrid
- Standards Based
  - Docker
  - Kubernetes
- First class Node.js support



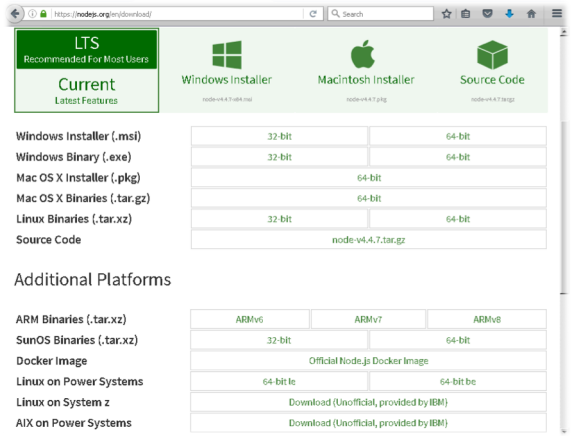
IBM **Cloud** → The Cloud for Enterprise



- **One Cloud Architecture**
- **Multi-cloud management**
- **Hybrid workloads**
- **Hybrid integration**
- **Multi-cloud DevOps**
- **Cloud native applications**
- **Containerized middleware**
- **Modernized applications**
- **Data and analytics**
- **Cognitive solutions**
- **Blockchain solutions**

Freedom of Platform Choice

- Community Binaries
  - Linux on Z
  - Linux on P
  - AIX



- IBM Binaries
  - IBM i
  - z/OS

Leveraging Existing Data Assets

- 68% of the world's production workloads and associated data is hosted in z/OS environments

- Enable Collocation with Data hosted on z/OS
  - Up to 2.5x better throughput,
  - 60% faster response time to DB2 on z/OS*

Enhance Node.js ecosystem to access z/OS middleware and assets

CICS, Db2, VSAM, etc.

* Based on performance test on Linux on Z

Tools to Accelerate Development/Deployment

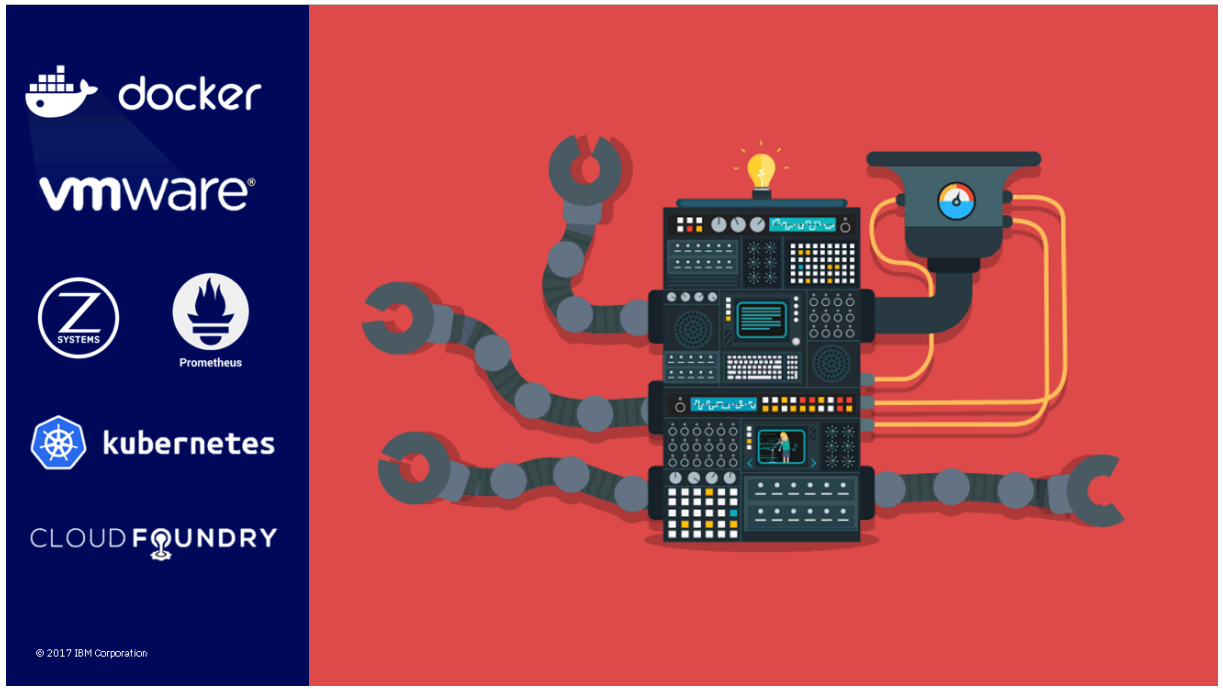
- NodeServer
- IBM Cloud Application Service
- MicroClimate
- AppMetrics
- Loopback
- Documentation/guidance

- Create
- Deploy
- Monitor

NodeServer – open source generators

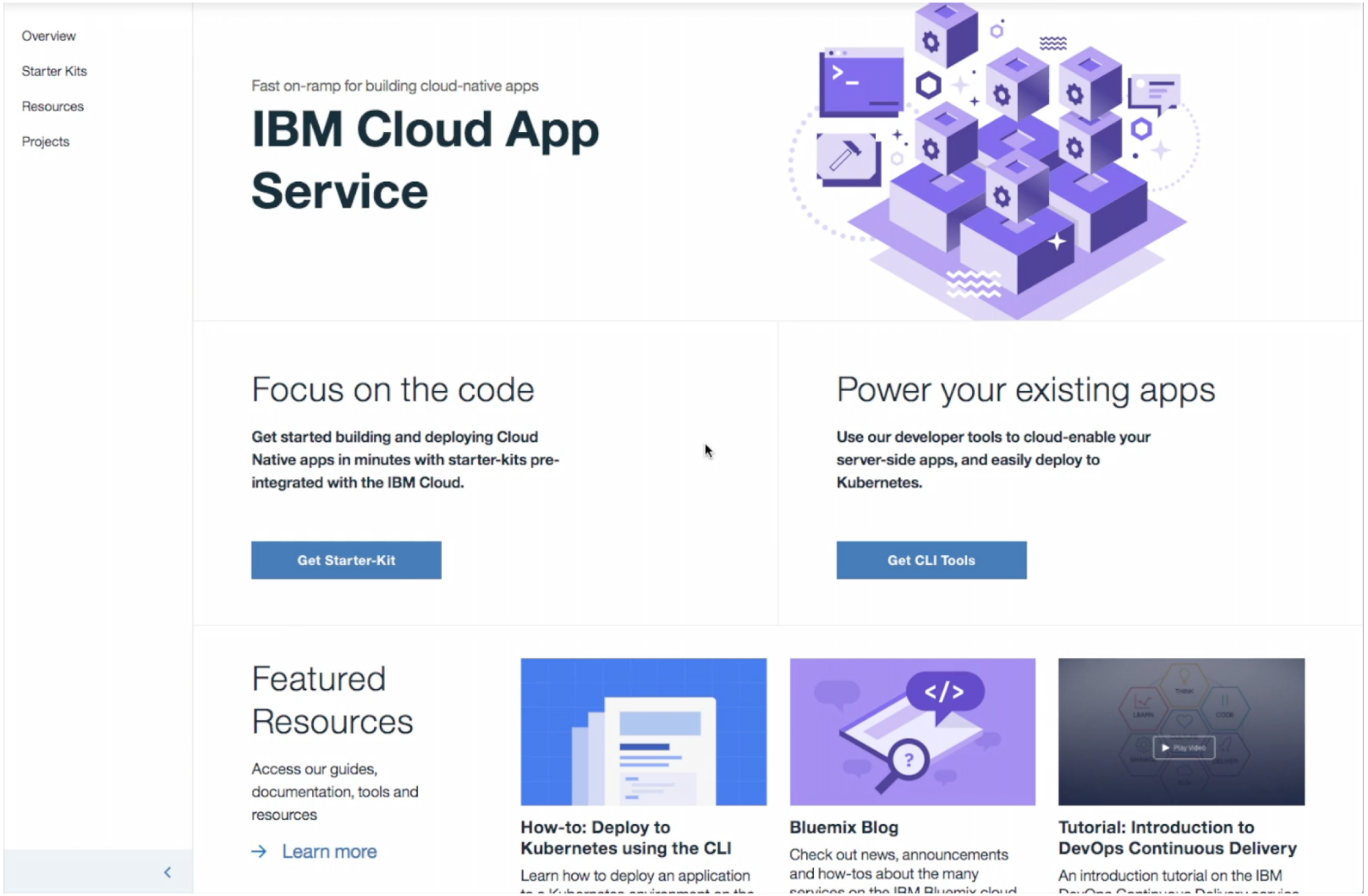
- Create Projects pre-wired for monitoring

- Deploy to
  - Docker
  - Kubernetes
  - Cloud Foundry
  - Dev-ops pipeline



https://www.npmjs.com/package/generator-nodeserver

IBM Cloud Application Service

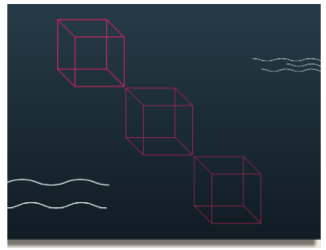


MicroClimate - IBM Developer Experience

Microclimate is an end to end development platform for the creation of cloud native applications and microservices. You can create, edit, build, test and deploy your applications via Continuous Delivery pipelines then run and manage them with IBM Cloud Private

https://microclimate-dev2ops.github.io/

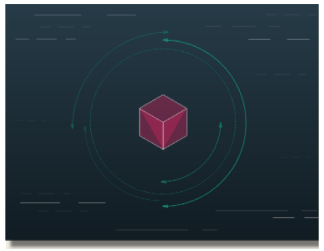
1



Containerized Development

Start to from scratch using lightweight containers that are easily reproducible to match your production environment locally or on IBM Cloud Private

2



Rapid Iteration

Lightning fast round-tripping through edit, build, and run allows real-time performance insights, regardless of what development phase you're in, with an integrated IDE or use your editor of choice with Language Server Protocols

3

Intelligent Feedback

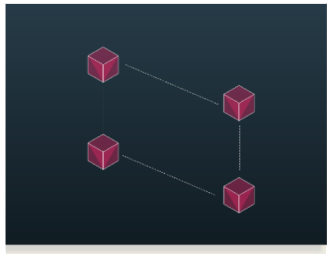
Best practices and immediate feedback to help improve your application through your IDE

4

Diagnostic Services

Add capability at development time to improve problem determination in production through application metrics.

5



Integrated DevOps Pipeline

Get into production fast with a preconfigured DevOps pipeline that can be tailored to your needs

AppMetrics - open-source Node.js monitoring

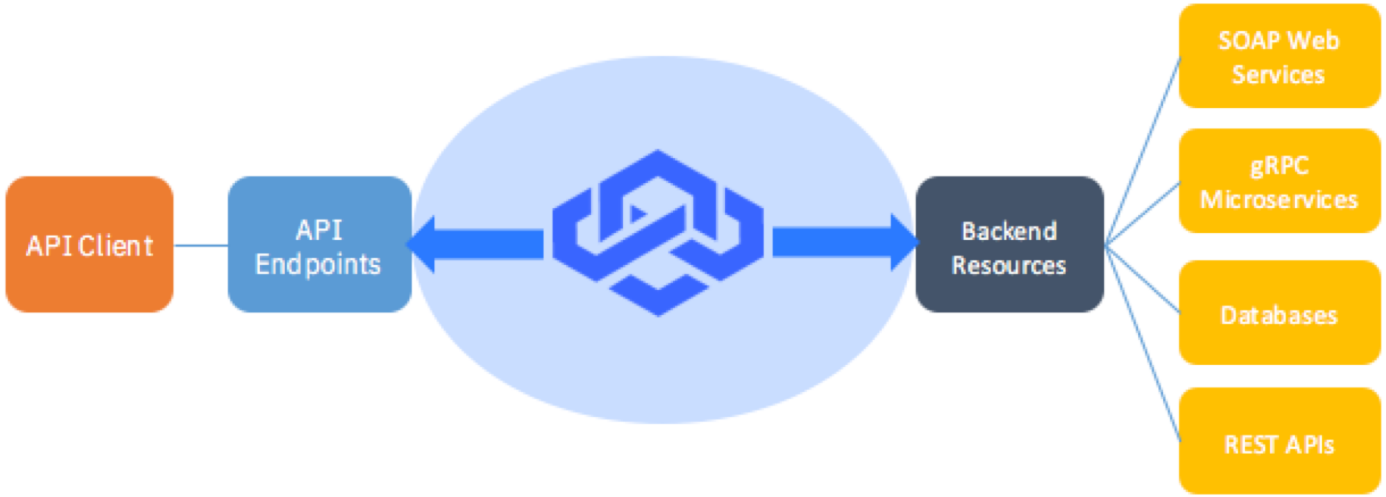
What is it?
An open source module created by IBM for collecting application metrics to diagnose issues while developing your application. Metrics range from HTTP requests, event loop, memory usage, CPU usage, MongoDB connects, and more.

Why use it?
Monitor and diagnose issues while developing your application. App Metrics then connects with IBM Cloud and API Connect for auto-scaling and more detailed availability monitoring

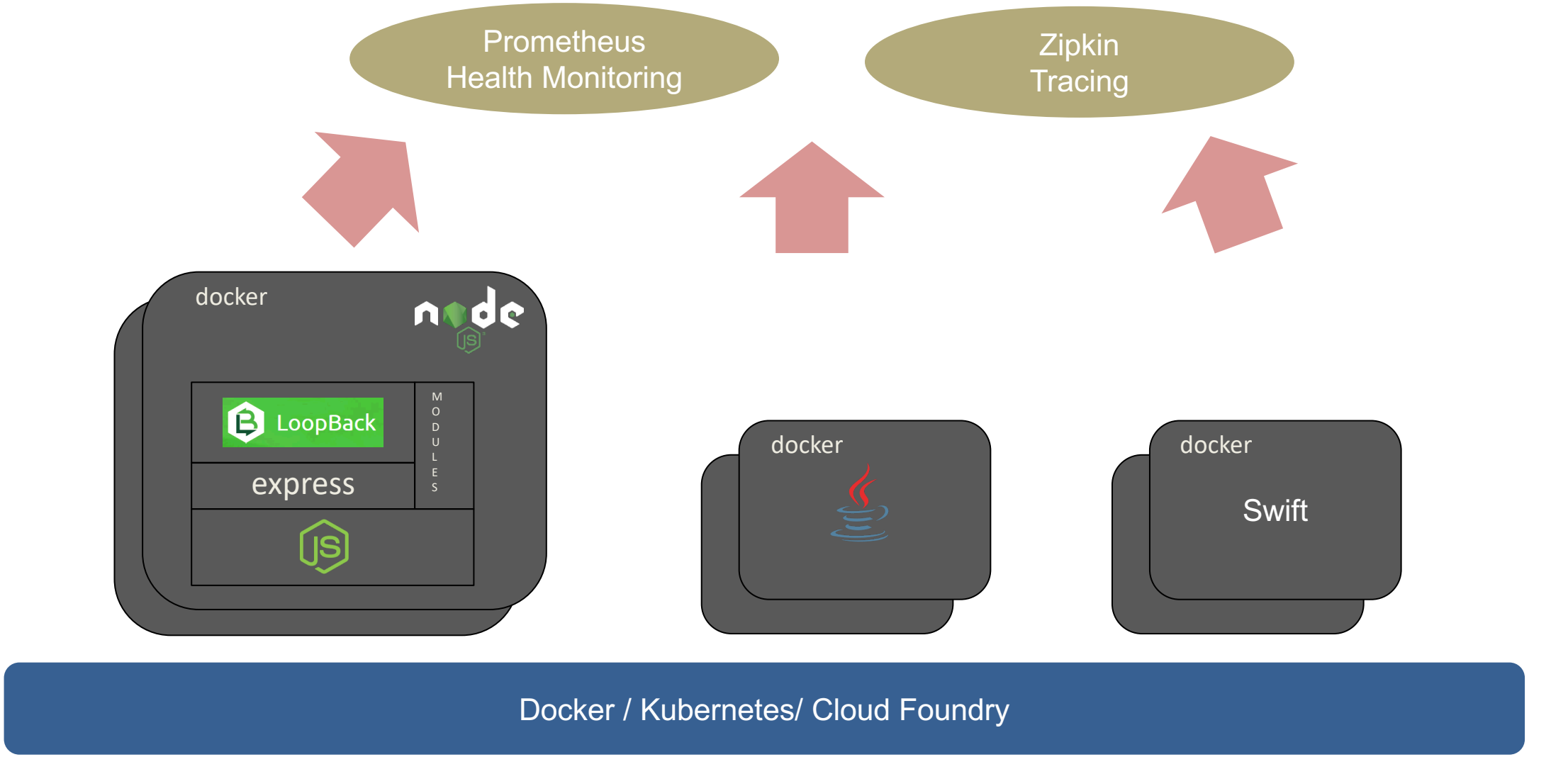
How to get it?
Github at https://github.com/RuntimeTools/appmetrics. Users can view the dashboard by going to /appmetrics-dash or feeding it into their existing dashboard.

LoopBack – open-source Node.js framework

- Extends Express to accelerate API creation
- Create APIs quickly as microservices from existing services and databases
- Connects the dots between accepting API requests and interacting with backend
- Built for developers by developers (Reached 10k+ GitHub stars)
- LB3 is for production use. LB4 is under active development
- LB4 brings in support for TypeScript



Tools to Accelerate Development – End Result



Production Support - IBM Support for Runtimes

- Years of experience
- Foundation -Community binaries
- Advanced – Key Modules from the Ecosystem

https://www.ibm.com/uk-en/marketplace/support-for-runtimes/faq

Questions
&
Answers