DevOps Fast Start for IBM Z: Node.js on z/OS

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Session Objectives

— Provide an overview of Node.js on z/OS

— Explain benefits of running Node.js on z/OS and how it can help accelerate digital transformation on z/OS

— Go over usage scenarios.

Agenda

- Node.js - z/OS Technology Overview

- Digital Transformation

- Connecting to critical applications
  and data on z/OS

- Usage Scenarios

- Tools

- Q & A

Node.js - z/OS Technology Overview

What is Node.js ?

Server-side JavaScript platform

- Built on Google's V8 JavaScript engine

Designed to build scalable network applications

- Lightweight and efficient

Uses an event-driven, single-threaded, non-blocking I/O model

- Best suited for data-intensive (i.e. I/O bound) applications

Provides a module-driven, highly scalable approach to application design and development that encourages agile practices

Emerging as the favored choice for digital transformation - Steadily establishing its place within enterprises

The Event Loop
Allows Node.js to perform non-blocking and asynchronous operations

- Node.js is a Single-threaded Application

- Supports concurrency via events and callbacks

- Loop that listens for events, and then triggers a callback function when one of those events is detected.

**Fast food restaurant**
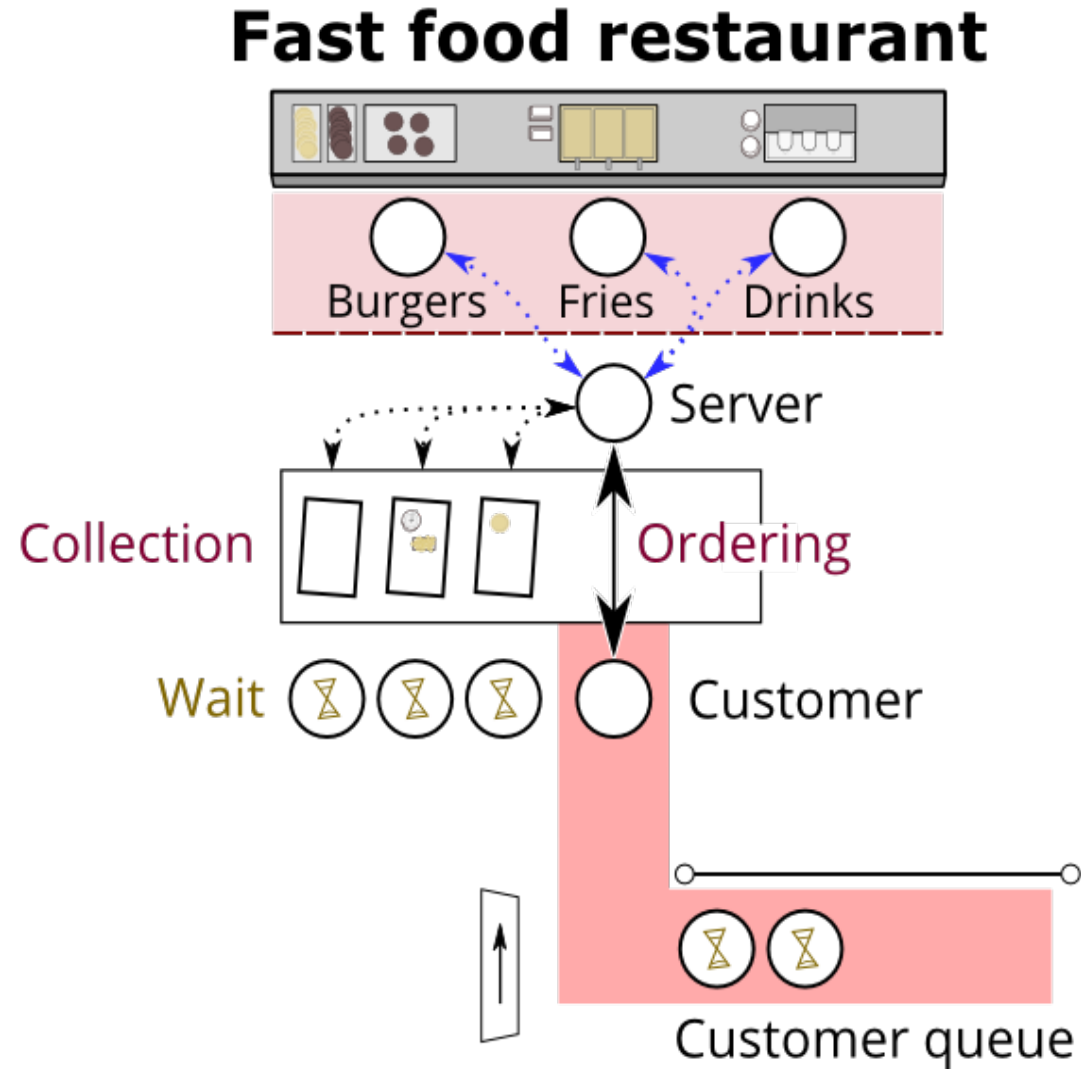
Node.js Ecosystem

— Largest repository of modules:

- NPM: Node Package Manager
  - Repository of community contributed modules
  - 900+k modules and growing!
  - 3x growth rate vs other runtimes
  Averaging 595/day

— *Enterprise clients can easily augment existing IBM Z applications to provide timely response to customer requirements driven by digital transformation*
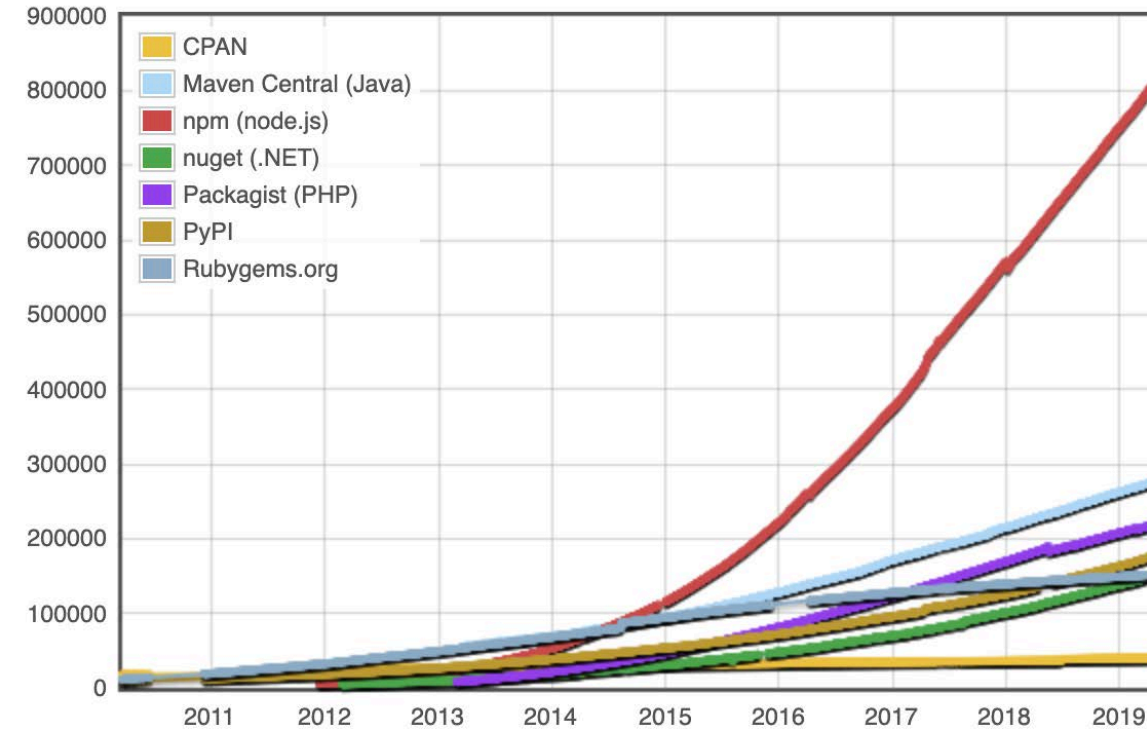
Apr 2019 – modulecounts.com

IBM SDK for Node.js – z/OS: Value to Enterprises

Take advantage of the enormously popular and growing technology on IBM Z to power digital transformation.

Access a vast pool of 11+ million JavaScript developers

Develop business logic using Node.js on z/OS

Take advantage of its great cross-platform support and deploy Node.js applications written on x86 to Z

Take advantage of co-location of Node.js applications with critical assets (i.e. applications and data) on z/OS

– Reduce response time and increase throughput

IBM SDK for Node.js – z/OS: Value to Development Organizations

Use a common language (i.e. JavaScript) to develop applications for the entire application stack (both client & server).

Increases efficiency, simplifies build process, and quickens time to market.

Leverage over 900k "good-to-go" NPM packages that can be used instantly in applications

Use module-driven, highly scalable approach to application design, development, and deployment
- Encourages Agile practices

Ordering SDK for Node.js – z/OS
Things you should know

SDK for Node.js – z/OS (Official product) is available on Shopz

– Zero license charge with Optional S&S - full production license

- S&S is included by default and is eligible for container pricing

If you need S&S, you do not need to do anything

– S&S will be billed automatically

If you *do not* need S&S, inform IBM rep to help you "opt out" of it

– Example

- Use Node.js as a trial (e.g. PoC)

- Use Node.js in production but do not need S&S

- Satisfy prerequisite requirements for other IBM Product(s) or technology (e.g. Zowe or IBM products that uses Zowe)

– No official PMR support for Node.js but you can report problems in Git. S&S is included in IBM products that pre-reqs Node.js

If you want to try Node.js but don't want to order it from Shopz

– Download and install pax.Z version https://developer.ibm.com/node/sdk/ztp/

Node.js beta is available!

Open beta program has started!

This beta supports the Node v8.15.1 community version

Highlights includes:

- Updated npm 6.4.1 (Node.js package manager), which includes standardized lockfiles for cross-package-manager compatibility and automatic saving of newly installed packages without explicitly adding the—save flag

- IBM C/C++ compiler (njsc/njsc++) to support -fexec-charset option to set the execution character set, used for string and character constants

- Functional enhancements over Node v6 (in DNS and OS modules)

- async/await, a modern approach that allows you to write asynchronous code that looks like synchronous code

- Buffer module security enhancements

– Register and Download the driver : https://developer.ibm.com/mainframe/products/ibm-sdk-for-node-js-z-os-open-beta/

– Questions or comments you can reach us on GitHub : https://github.com/ibmruntimes/node/issues

For more details, contact Jennifer Rowan, Node.js z/OS offering manager jenrow@ca.ibm.com

Digital Transformation is a key focus for every industry

Goal: Integrate digital technology into all areas of businesses to deliver value to customers and drive business growth

Banking and Financial Services

Government

Healthcare

Automotive

Retailers

The **mainframe** and enterprise assets are at the center of a **digital enterprise**

Virtually Limitless Scale

1.3 million CICS transactions are processed every second, every day...**20X** the number of Google searches.

Trusted Computing

The **highest level of security** certification for commercial server and **99.999%** application availability.

Enterprise Data Serving

Over **80%** of all corporate structured data

Business Critical Applications Serving

$3T of all daily commerce flows through **COBOL Applications**

The best way to accelerate Digital Transformation for your organization

Leverage existing critical assets and data on IBM Z mainframe and extend them to support new mobile or cloud applications
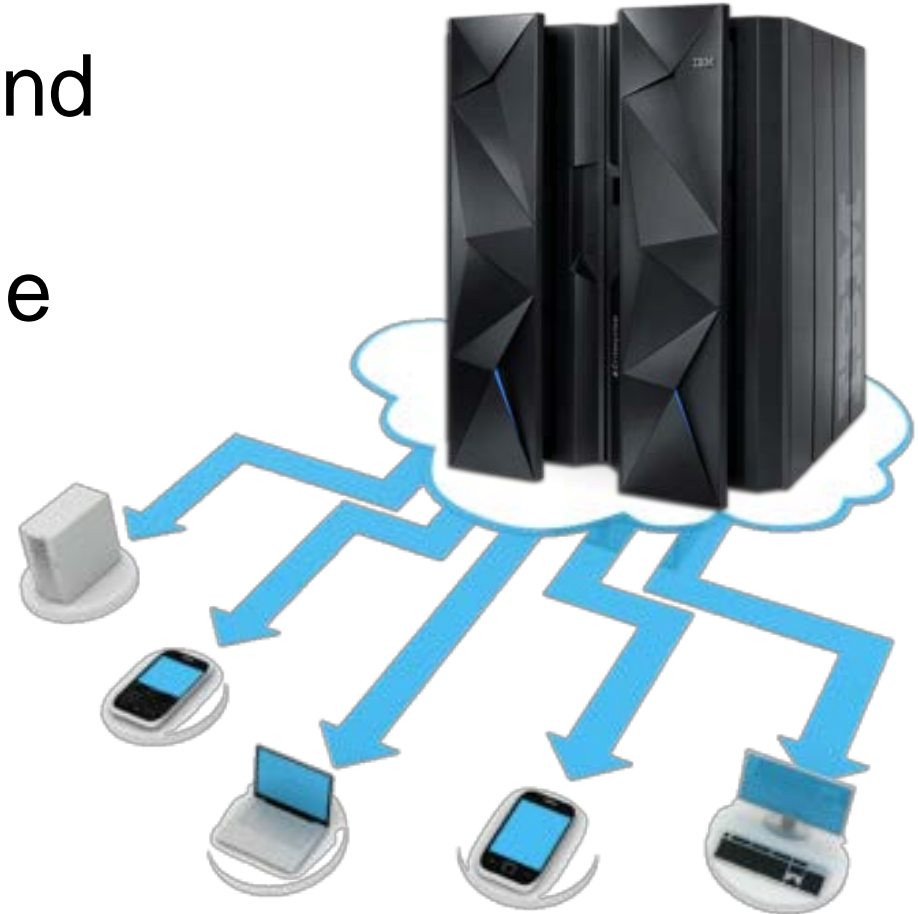
Node.js is ideal for Digital Transformation

Simplicity:
   JavaScript is simple, powerful & lightweight
   Support for full stack development

Encourages Agile practice
   Ecosystem of over 900k+ npm packages
   50% less code written – less bugs, less testing
   Quicker delivery

Performance
   Suited for I/O intensive applications
   Highly scalable
   Exploits IBM Z's I/O capabilities

Availability of Skills
   Developer population of 11+M

Suited for APIs and Microservices
   Speaks JSON - REST APIs

Open Architecture
 Open-source project
 Active and vibrant community willing to
      share code
 Strong cross platform support

Connecting to critical applications and data on z/OS

npm

Connecting to z/OS assets

Z/OS Connect EE

- Access z/OS assets exposed through REST APIs
- Discover and Access APIs: npmjs.com/package/zosconnect-node
- Loopback connector: npmjs.com/package/loopback-connector-zosconnectee

Db2

- Direct ODBC access to IBM Db2 on z/OS: npmjs.com/package/ibm_db

IMS

- Access data in IMS through z/OS Connect EE

CICS

- Node.js CICS Bundles managed by CICS 5.5 ibm.co/2vG1KTb
- Locally-optimized transport to call CICS service: npmjs.com/package/ibm-cics-api

VSAM

- Interact with z/OS VSAM datasets and records npmjs.com/package/vsam.js

z/OS Node Accessor

- Module to interact with z/OS MVS dataset and USS files and simple JCL operations: npmjs.com/package/zos-node-accessor
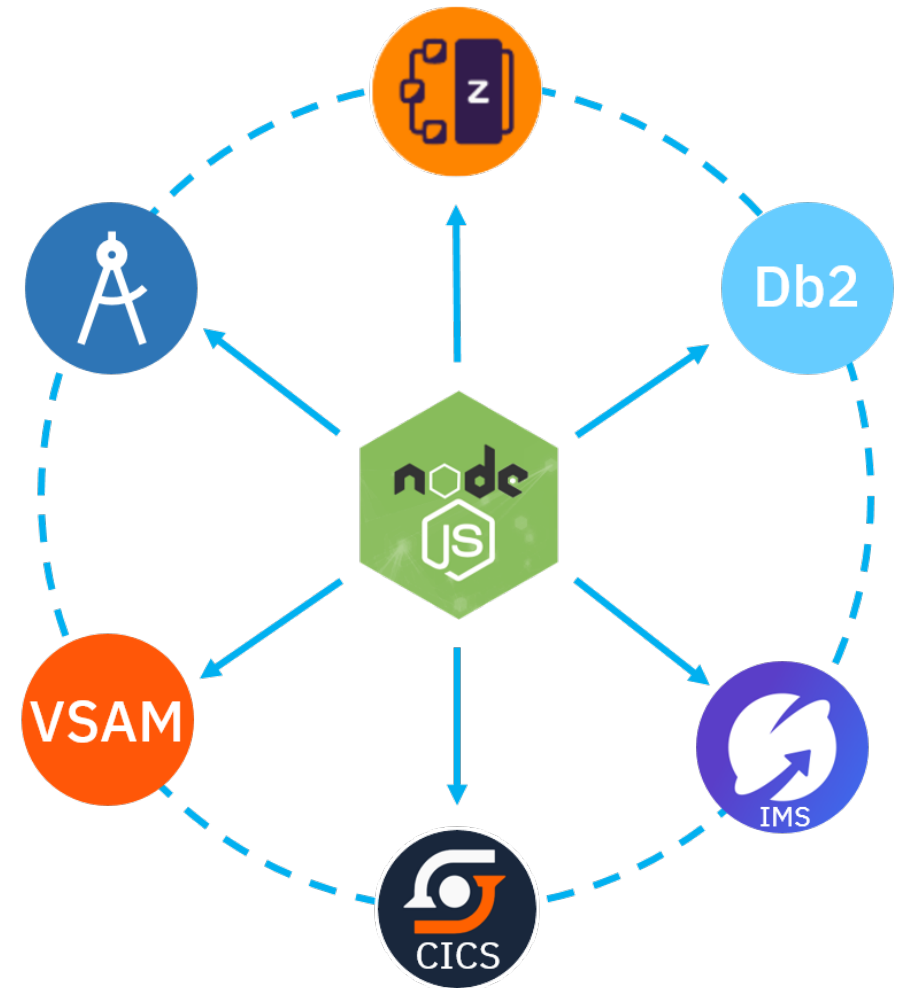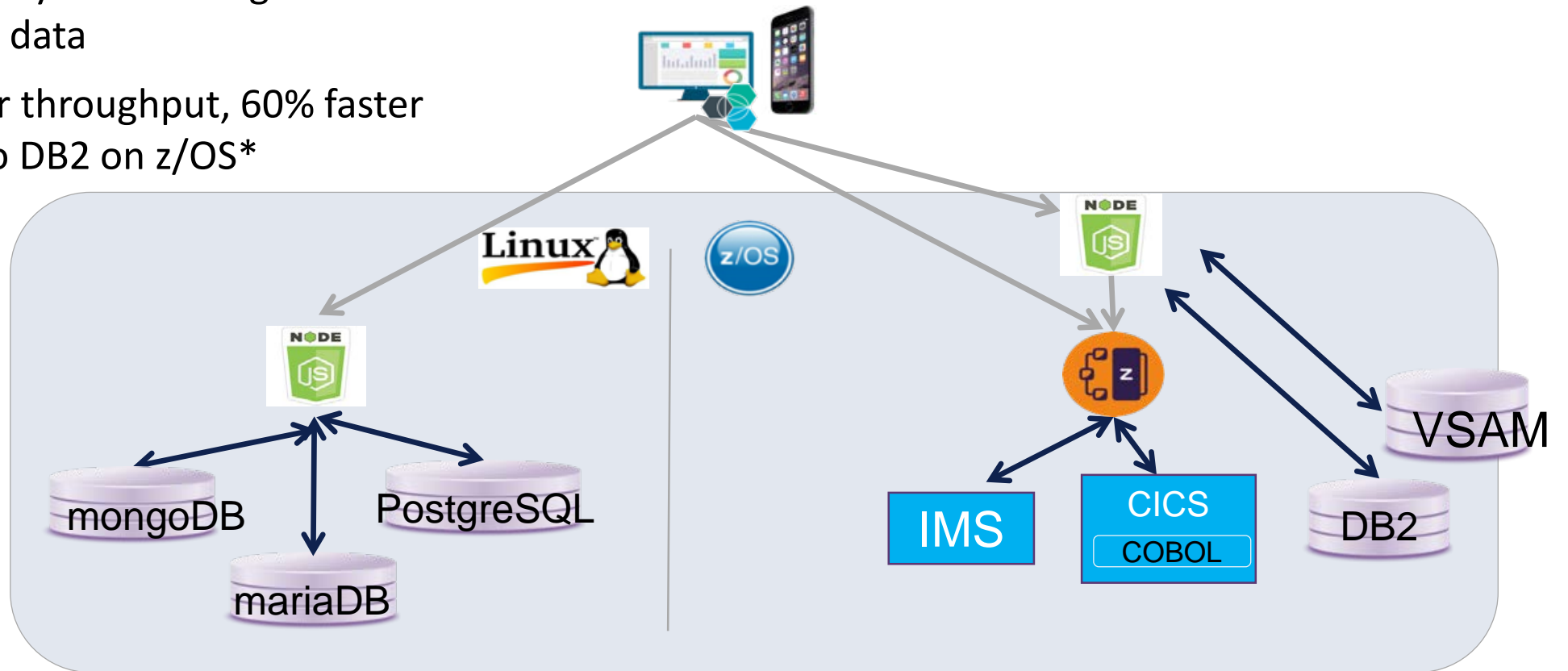
# Usage Scenarios
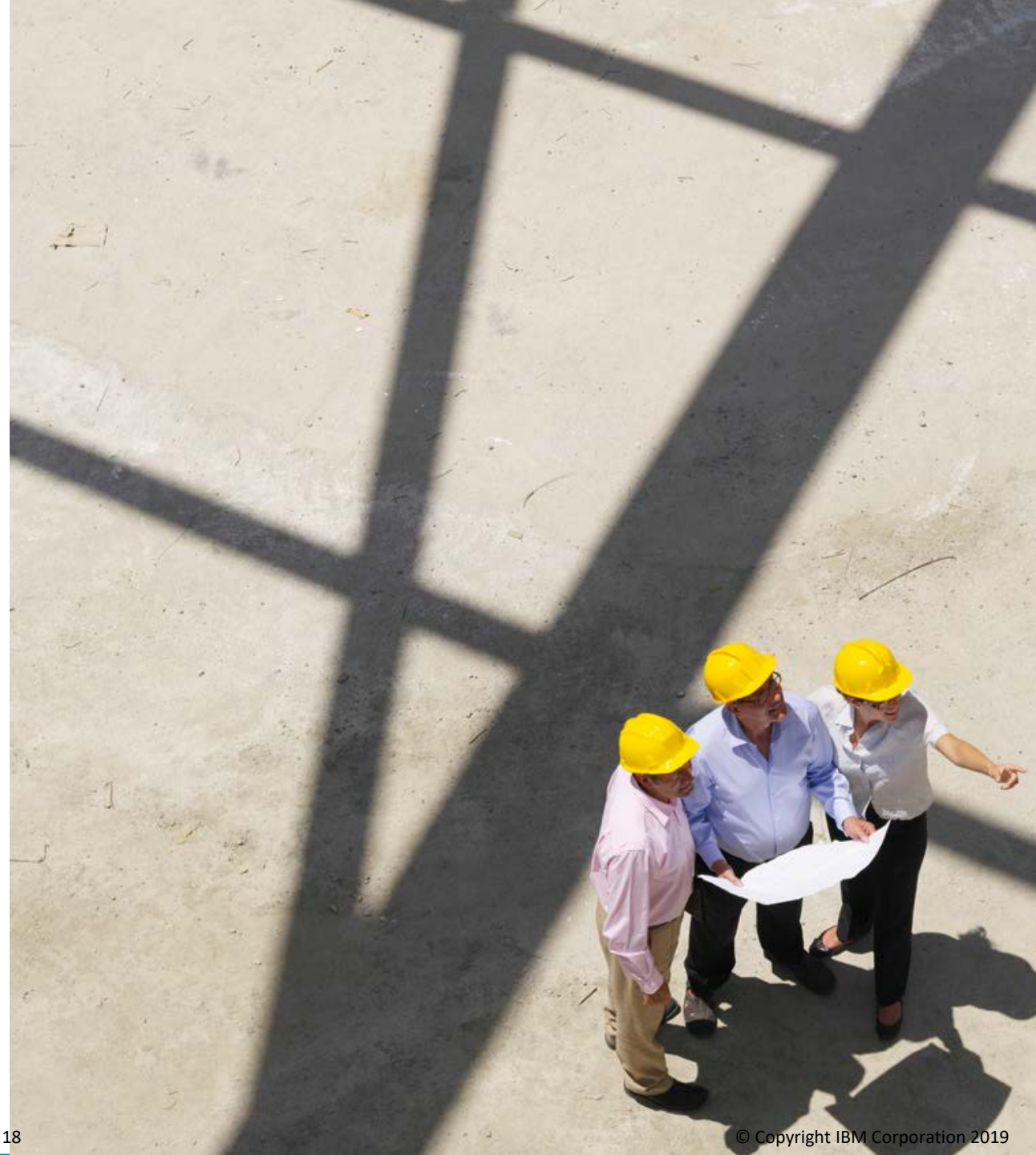
Co-locate with critical assets on z/OS

— Move existing Node.js application to z/OS for reduced latency in accessing critical applications and data

— Up to 2.5x better throughput, 60% faster response time to DB2 on z/OS*
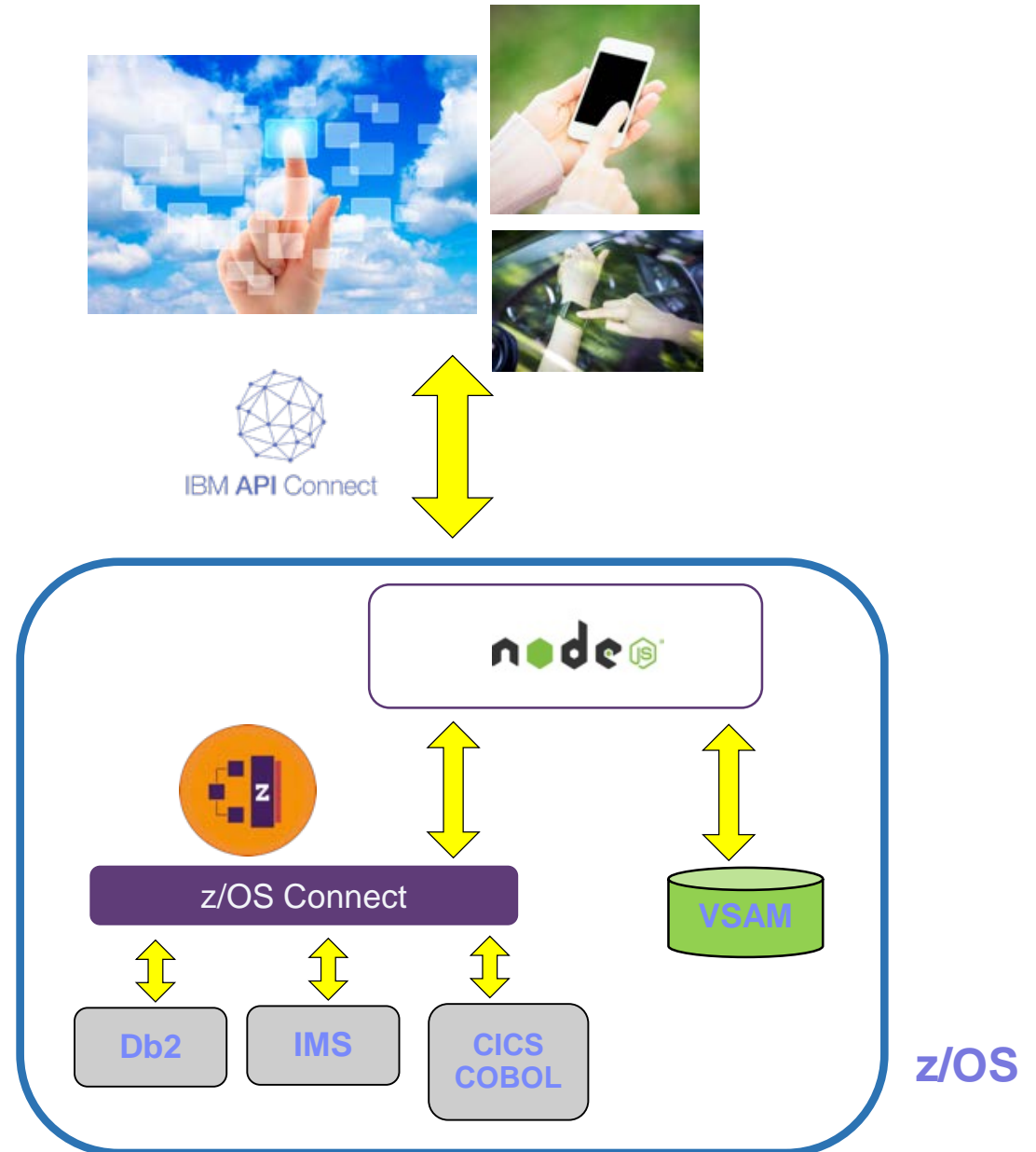

NODE JS

Linux

z/OS

NODE JS

mongoDB **PostgreSQL**

mariaDB

IMS **CICS** **COBOL** **DB2** **VSAM**

* Based on performance test on Linux on Z

API Orchestration/Microservices Management

- Often, there exists a mismatch between granularity of APIs of individual services, and data a micro service needs to provide

- Data flow requires multiple services to interact in some manner

- Leverage the consistency models of z/OS data stores

- Leverage the colocation to z/OS transactions and assets for better response time and security

Microservice API

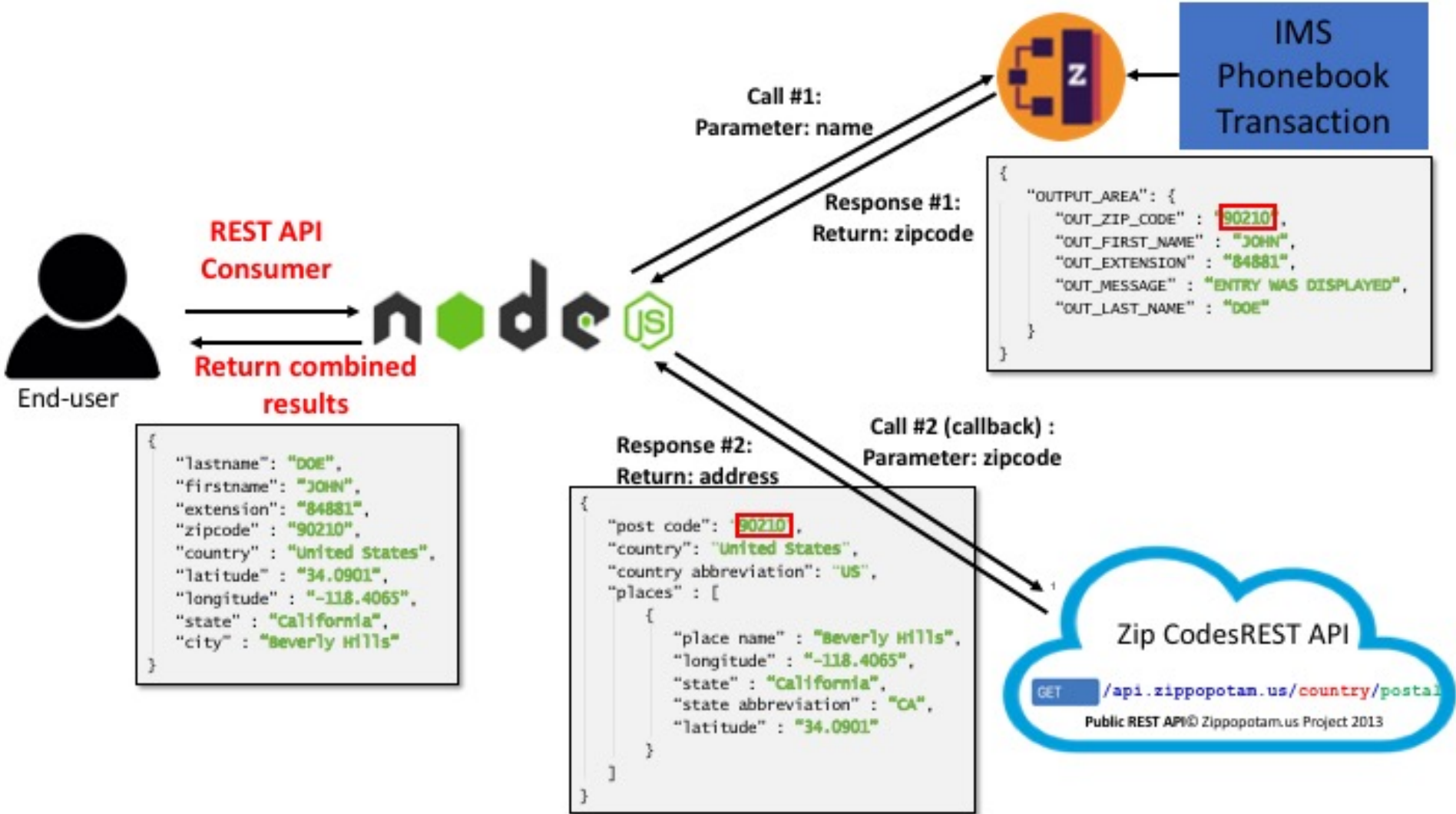CICS

IMS

WAS

MQ

DB2

20
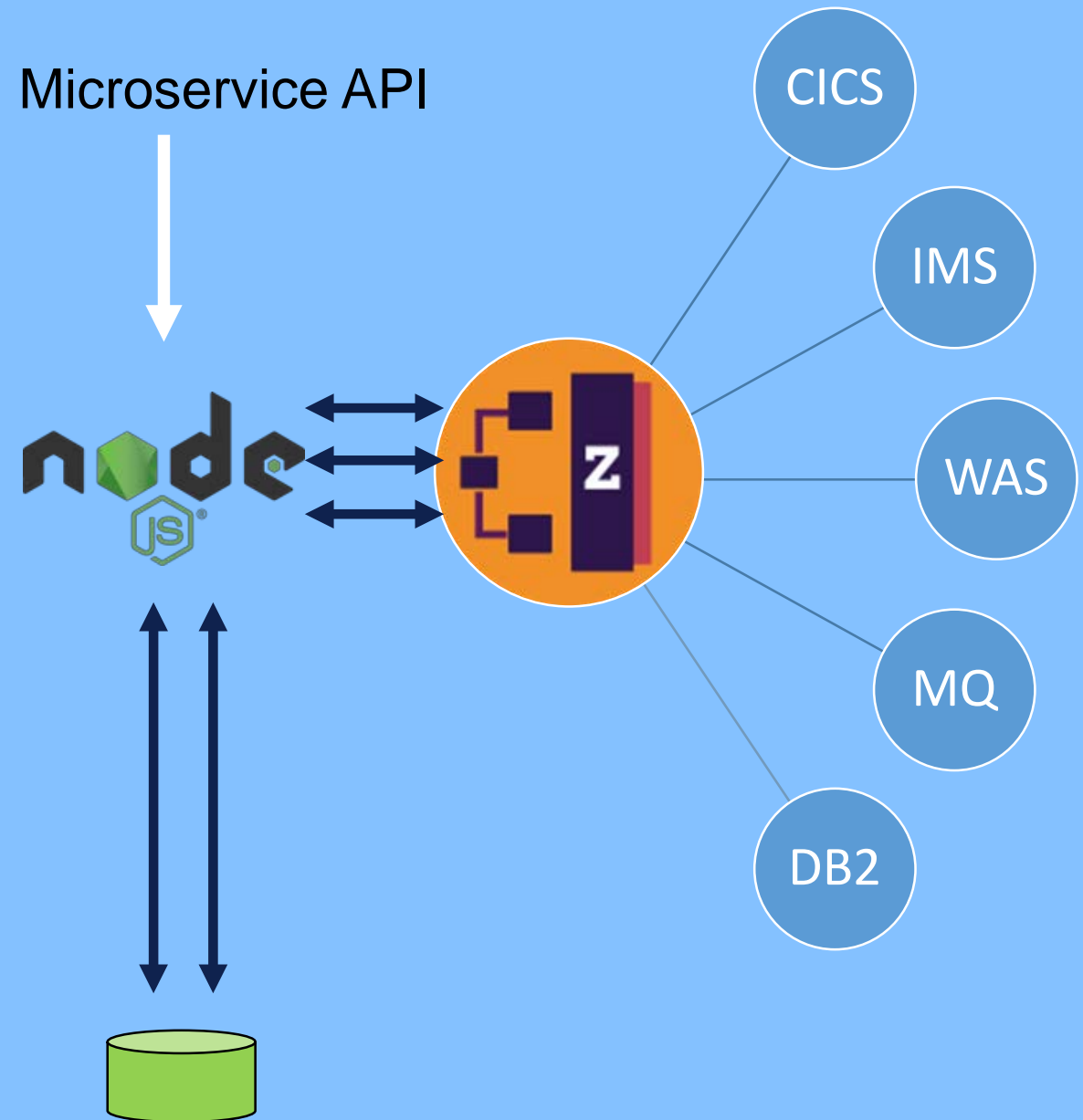
API Orchestration/ Microservices Management - Benefit

- Increase organization efficiency
    - Provide exact information requested by incoming API's
    - Avoid exposing more APIs than necessary
    - Simplify API development and maintenance

- Take advantage of co-location of critical assets and data

- Increase Security
    - Data remains on Z
    - Controls what data is going out of the system
   - Leverage zOS connect and API connect

API Orchestration/Microservices Management - Example

Call #1:
Parameter: name

Response #1:
Return: zipcode

IMS Phonebook Transaction

```
{
    "OUTPUT_AREA": {
        "OUT_ZIP_CODE" : "90210",
        "OUT_FIRST_NAME" : "JOHN",
        "OUT_EXTENSION" : "84881",
        "OUT_MESSAGE" : "ENTRY WAS DISPLAYED",
        "OUT_LAST_NAME" : "DOE"
    }
}
```

REST API Consumer

Return combined results

End-user

```
{
    "lastname": "DOE",
    "firstname": "JOHN",
    "extension": "84881",
    "zipcode" : "90210",
    "country" : "United States",
    "latitude" : "34.0901",
    "longitude" : "-118.4065",
    "state" : "California",
    "city" : "Beverly Hills"
}
```

Call #2 (callback) :
Parameter: zipcode

Response #2:
Return: address

```
{
    "post code": "90210",
    "country": "United States",
    "country abbreviation": "US",
    "places" : [
        {
            "place name" : "Beverly Hills",
            "longitude" : "-118.4065",
            "state" : "California",
            "state abbreviation" : "CA",
            "latitude" : "34.0901"
        }
    ]
}
```

Zip CodesREST API

GET /api.zippopotam.us/country/postal

Public REST API© Zippopotam.us Project 2013

https://developer.ibm.com/mainframe/2018/09/21/nodejs-zos-api-orchestration/

API Gateway

— Router

— Load balancer

— Application Endpoint

— Token endpoint

— Authorization

— Monitoring

— Rate Limiting

— Proxy

API Gateway

z/OS

App   App   App   App   App   App
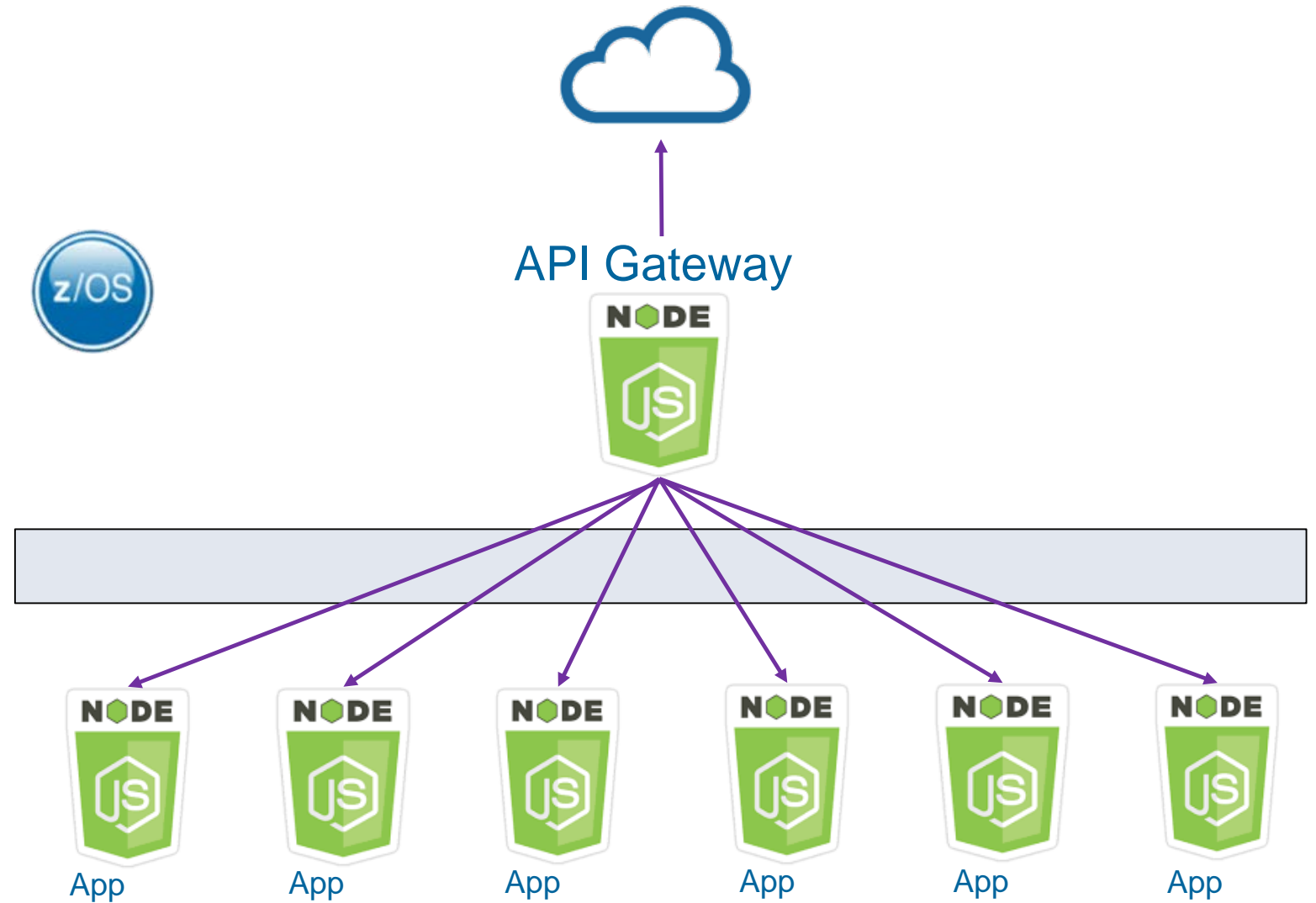
Develop Web Applications

Node.js web application framework
- Provides a set of features for web and mobile applications
(npm install express –save)

Example: HelloWorld express application:

```
const express = require('express')
const app = express()

app.get('/', (req, res) => {res.send('Hello World!');});

app.listen(3000, () =>
        console.log('hw app listening on port 3000!'));
```

Express

https://www.npmjs.com/package/express

A number of popular Node.js frameworks are built on Express
- Example: LoopBack, MEAN…

Create REST APIs

LoopBack framework

- Open-source Node.js framework for developing APIs

- Makes it easy to create APIs

- Use with IBM API Connect to secure, manage and monitor APIs.

- Built-in API Explorer

Loopback: https://loopback.io/

IBM API Connect: https://ibm.co/2US7nix

Create API - Example

— Credit Card Rewards Program Case-Study

- Create APIs with Node.js application using LoopBack framework

- Exposes Rewards data, while keeping all customer and credit-card data secure
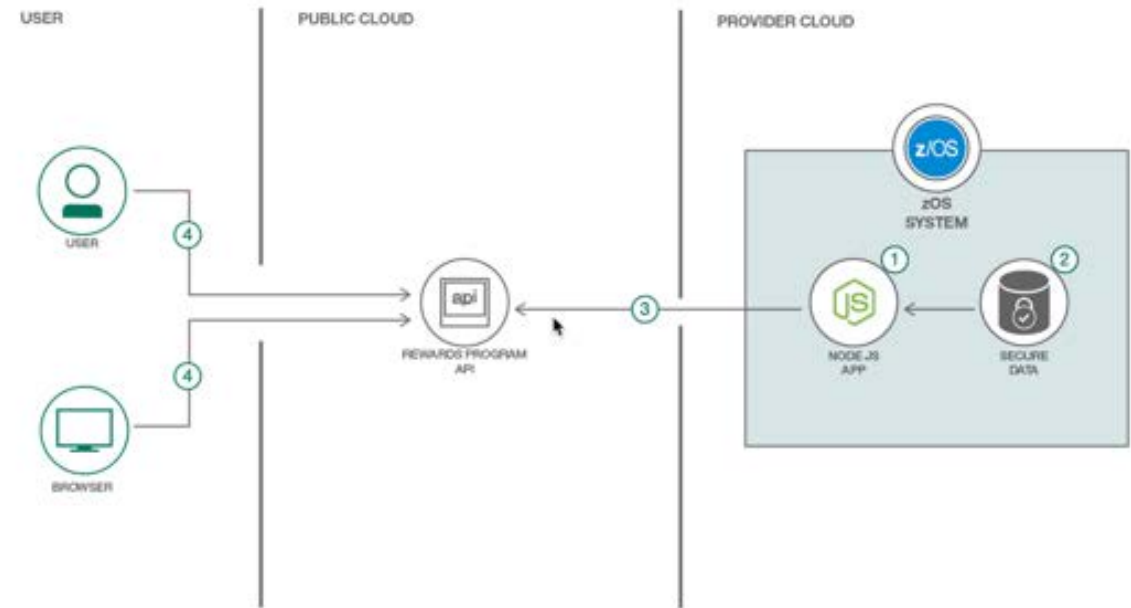
① Create a Node.js rewards program application using the LoopBack framework.

② Deploy the Node.js application on z/OS to benefit from collocation advantages such as performance and security.

③ Expose the rewards program APIs. (Note: The credit card and customer info remains secure in z/OS.)

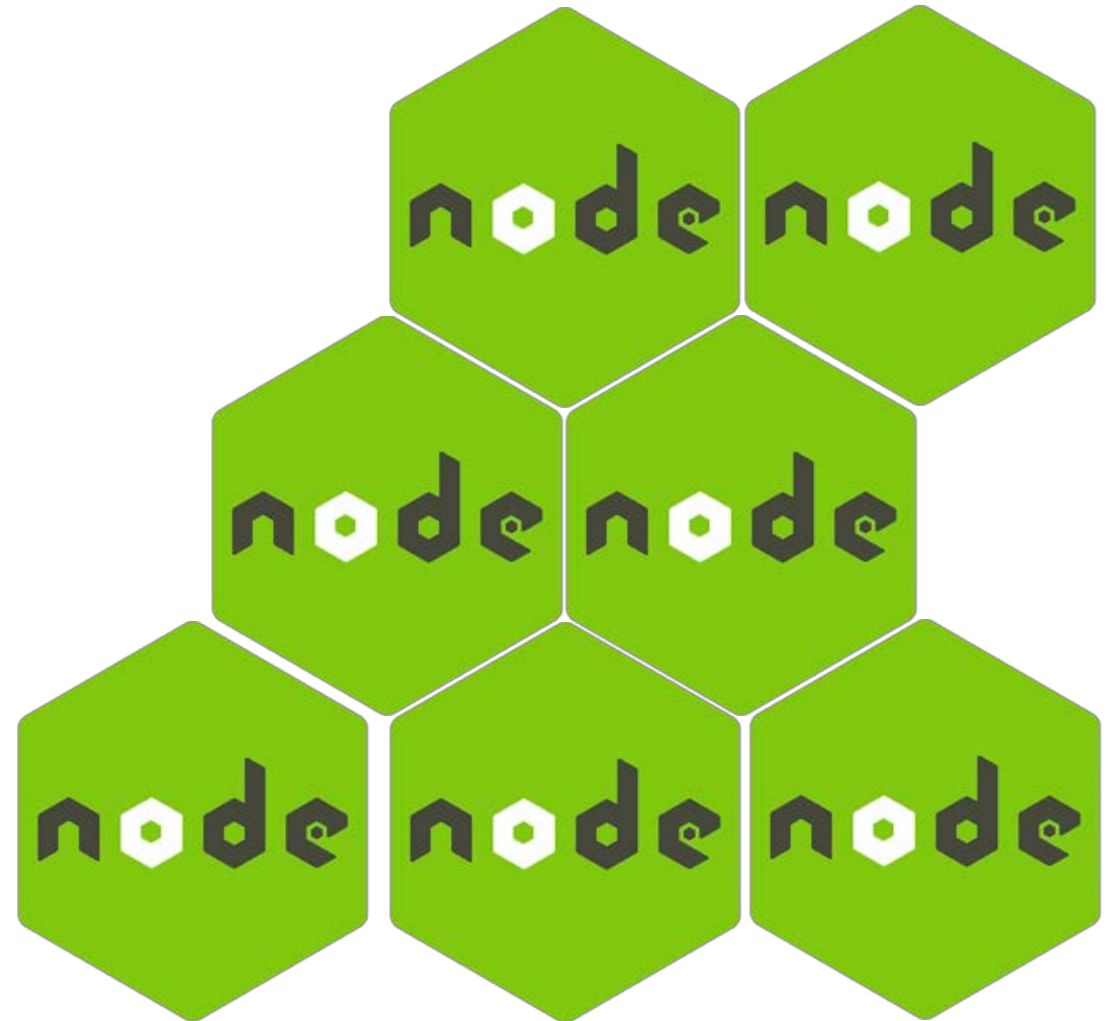④ Explore, test, and consume the APIs that you have created.

Included Components LoopBack

https://developer.ibm.com/code/patterns/create-rewards-program-apis/

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Node.js Microservices

Microservices architecture

- Replaces Monolithic design

- Built of many small, modular services

- Allows for agility and continuous delivery

- Improves productivity

- Benefit from lightweight communication

Try it yourself!   VSAM and API Orchestration scenarios on zTrial

Tools

Tools - Debugging

V8 Inspector Protocol supported

Exposed via `--inspect` flag in Node.js

Process listens WebSockets for diagnostic commands

Various client support: node-inspect, Chrome DevTools, Eclipse plugins, Visual Studio Code, etc.

https://nodejs.org/en/docs/guides/debugging-getting-started

Tools

Monitoring - Unified diagnostics tooling with IBM SDKs for Java®

- Appmetrics - Node Application Metrics
  - npm module instruments the Node.js runtime for performance monitoring
  - https://www.npmjs.com/package/appmetrics

- Health Center
  - Quick to deploy, small impact live monitoring tool
  - Tracks Memory, CPU usage, Garbage collection, application hot spots, and more
  - http://www.ibm.com/developerworks/java/jdk/tools/healthcenter

- **Post Mortem Investigation**
  - FFDC with node-report –
    - https://github.com/RuntimeTools/node-report   (z/OS)
  - heapdump - https://github.com/bnoordhuis/node-heapdump
  - llnode support in works

ibm.biz/nodejs-RAStools
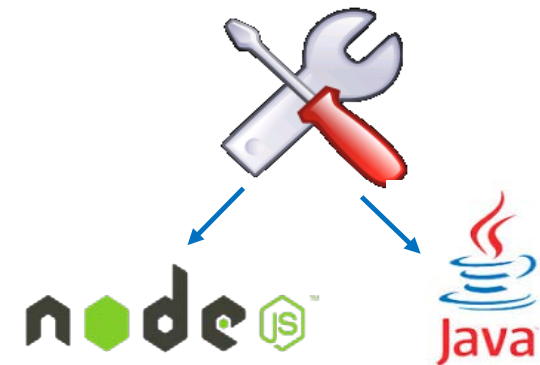
Trials

Order IBM SDK Node.js – z/OS on Shopz

– No license Charge

– Full Execution License

– Optional S&S

Download pax.Z version from https://developer.ibm.com/node/sdk/ztp/

• No Charge

• Evaluation License (not suitable for deployment)

Resources

— Node.js
  - IBM Marketplace Page: https://www.ibm.com/us-en/marketplace/sdk-nodejs-compiler-zos
  - Link to announcement blog: https://ibm.co/2uvnrsu
  - Link to Node.js blog: https://developer.ibm.com/mainframe/2018/01/19/reasons-host-node-js-applications-zos/
  - Link to IBMSystems magazine article: http://bit.ly/2x7ODPx
  - Application Example: https://developer.ibm.com/code/patterns/create-rewards-program-apis/

  - Trials
    o PAX format: ibm.biz/nodejs-zos-trial-pax
    o Shopz: ibm.biz/nodejs-zos-trial
  - Documentation
    o Knowledge Center: ibm.biz/nodejs-zos-kc
    o DeveloperWorks: ibm.biz/nodejs-zos-sdk-v6-dw

Session summary

— Node.js on z/OS is now enabled on z/OS. It is based on the open source and has the same implementation as all other platforms

— You can take advantage of co-location of critical assets and data on Z mainframes to improve response time and throughput

— You can take advantage of the strong NPM ecosystem to deliver applications quickly, including connecting to IBM assets on z/OS

— API orchestration using for Node.js on z/OS can enhance API consumability, security and organization efficiency

Thank you!

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Please complete the Session Evaluation!
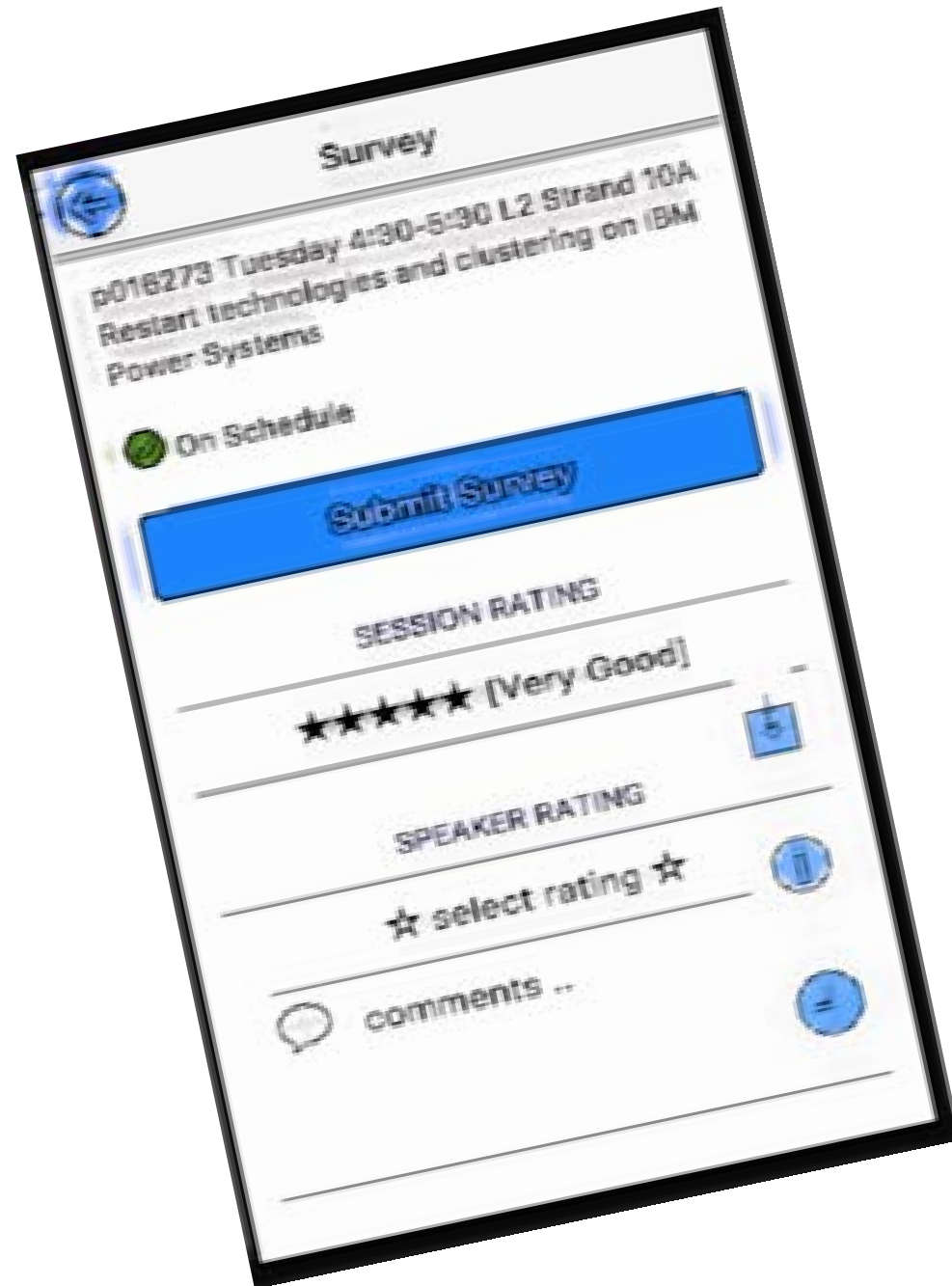
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