Power Week

Université IBM i 2019

22 et 23 mai

IBM Client Center Paris

for Business

S28 – Modernisation Applicative avec IBM Cloud Private

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Online version – EN & FR
https://ibm.biz/bma-wiki

Agenda

- Introduction - DevOps & Continuous Innovation
  - New Development Models & Paradigms
  - Cloud Computing, Containers & Technologies Docker, Kubernetes , Microservices
- IBM Cloud Private
  - What is IBM Cloud Private?
  - IaaS : ICP & CAM for Infrastructure Modernization, automation.
  - CI/CD, ICP & Microclimate for App Modernization
- ICP & IBM i: Integration w/ my IBM i Apps

- **Demonstrations**

Demonstrations

1. IBM Cloud Private : Quick tour
   Private AI (GPU as a Service) & App modernization cloud with Kubernetes Catalog / Helm

2. Automate IBM i VM provisioning with ICP, CAM & PowerVC

3. Microclimate , CI/CD basic demo

Presentations & Video Replay https://ibm.biz/bma-wiki

In a Nutshell…

- **Continuous innovation**, reactivity vs. Business & user needs implies a tool chain for automation (DevOps), new application architecture mixing Cloud Native apps (**Microservices**, **Containers**) easily updatable and traditional applications.
- **IBM Cloud Private** & **Kubernetes** hide the complexity of such Cloud Infrastructure and allow to manage containerized apps easily with little effort.
- Even if not always updated that frequently, **Modernizing** existing apps including ILE & Open source based apps on IBM i can be necessary vs. new business needs.
- By creating a Service Catalog on **Cloud Automation Manager** (Terraform based), you can orchestrate Cloud Native Apps running on Kubernetes/ICP or any Cloud (public/private) and Applications deployed on Virtual Machines & LPARs (PowerVC…)
- Automation tooling (CI/CD, Source to Image, SCM…) is necessary for managing frequent application updates: **Microclimate** on top of ICP , as well as other **CI/CD toolchain Solutions** for IBM i (Partner vendors).

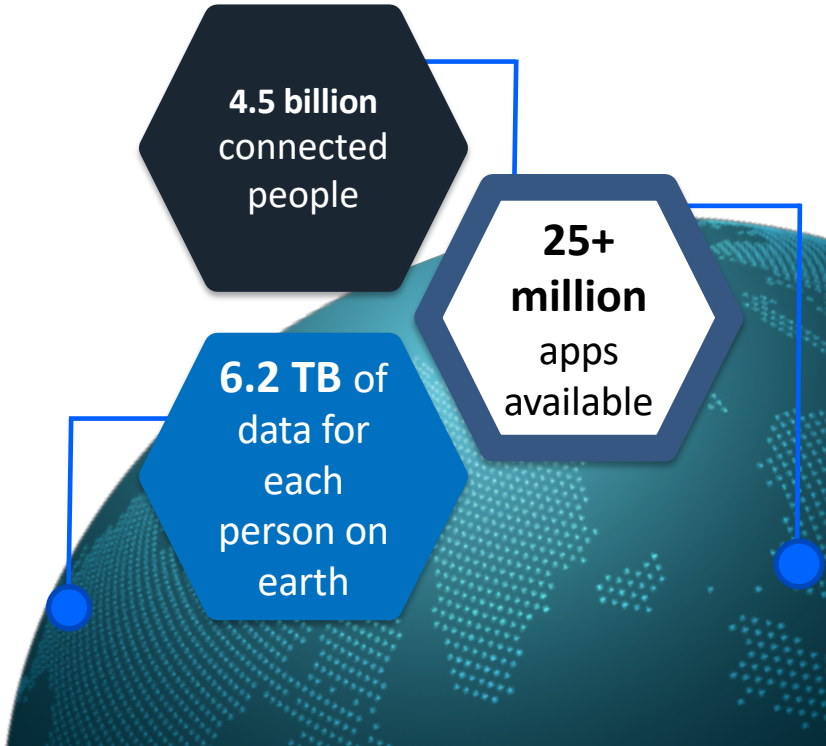
The world is becoming more connected than ever

Businesses must be ready to face the challenge

To win in the connected economy, **enterprises are focusing on interactions and value exchange** across a partner ecosystem

You need:

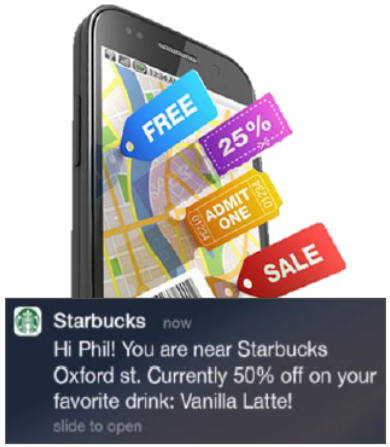
- A better, more compelling customer experience
- An infrastructure that scales out autonomously
- To bring teams together across a partner ecosystem
- Continuous innovation to deliver software faster, consistently, and reliably



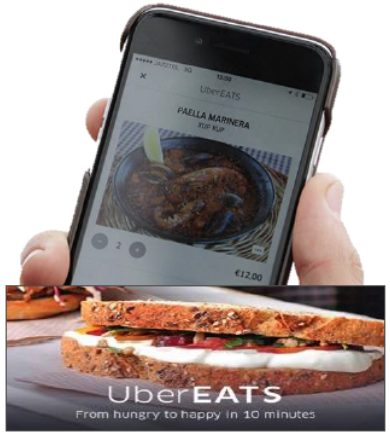
Source:[1] IDC: The Digital Universe of Opportunities: Rich Data and the Increasing Value of Internet of Things, April 2014

Source:[2] RisingStack: How Enterprises Benefit From Microservices Architecture, February 2016

Location Aware



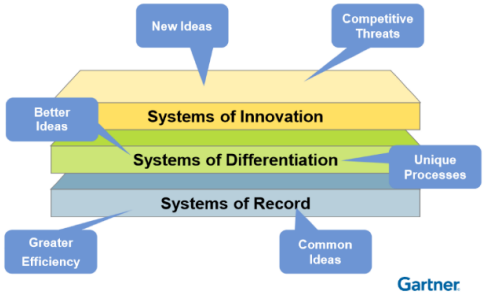
On Demand



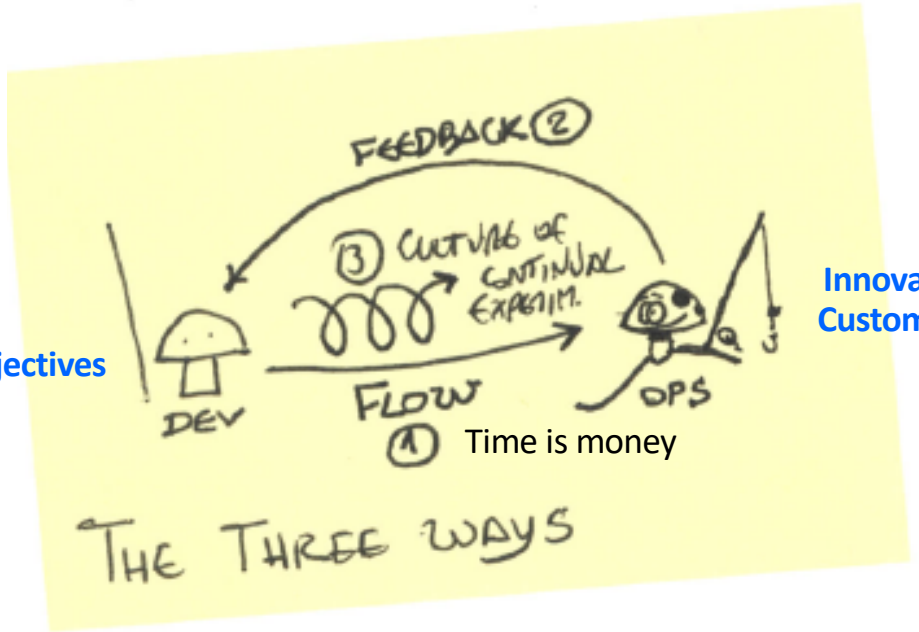
Personalized and Engaging

DevOps & Innovation continue

- DevOps “3 Ways”



Business Objectives & Ideas

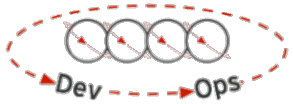


1. Accelerate Delivery
2. Feedback Loop
3.Continuous Innovation

Innovation Customer Experience

IT aligned with new business needs

Development Process	Application Architecture	Deployment & Packaging	Application Infrastructure
Waterfall	Monolithic	Physical Servers	Datacenter
Agile	N-Tier	Virtual Servers	Hosted
DevOps	**Microservices**	**Containers**	**Cloud**



Containers

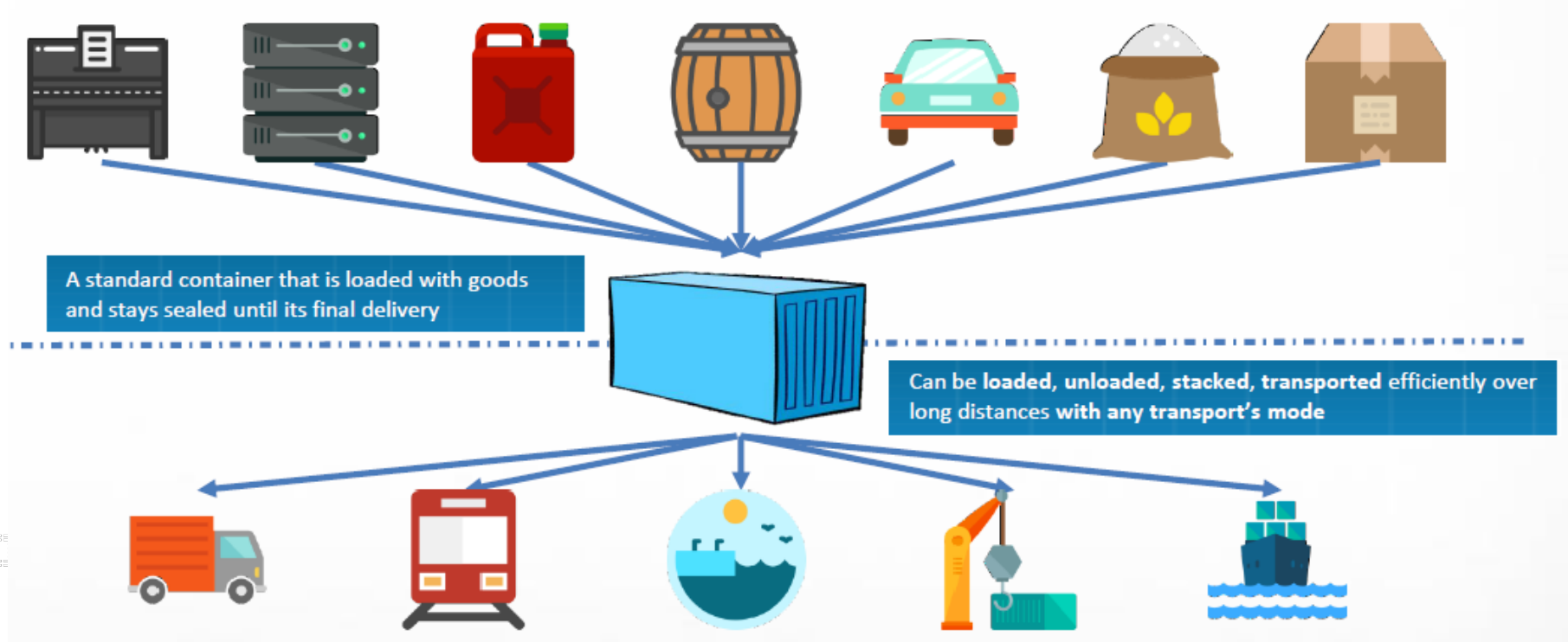
Containers vs. VM

Build

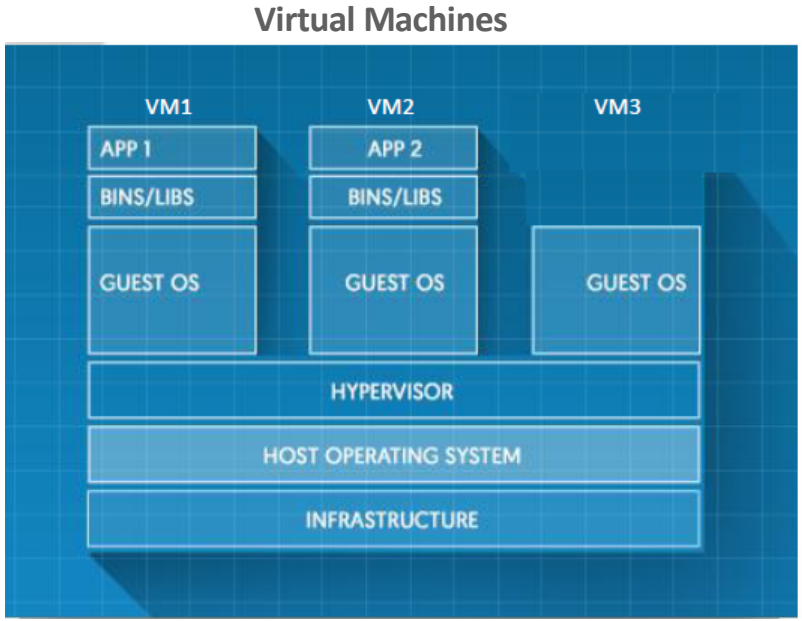
Ship

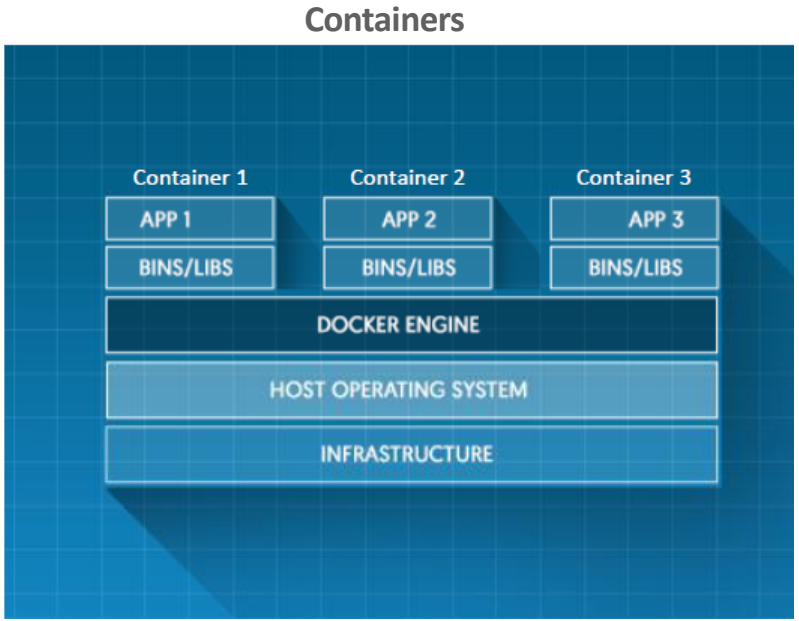
Run

Docker: Application portability



Containers vs VM





Virtualization Pro:

- Better Security / Isolation
- Allow different Kernel between VMs
- Not Limited to Linux OS

Containers Pro:

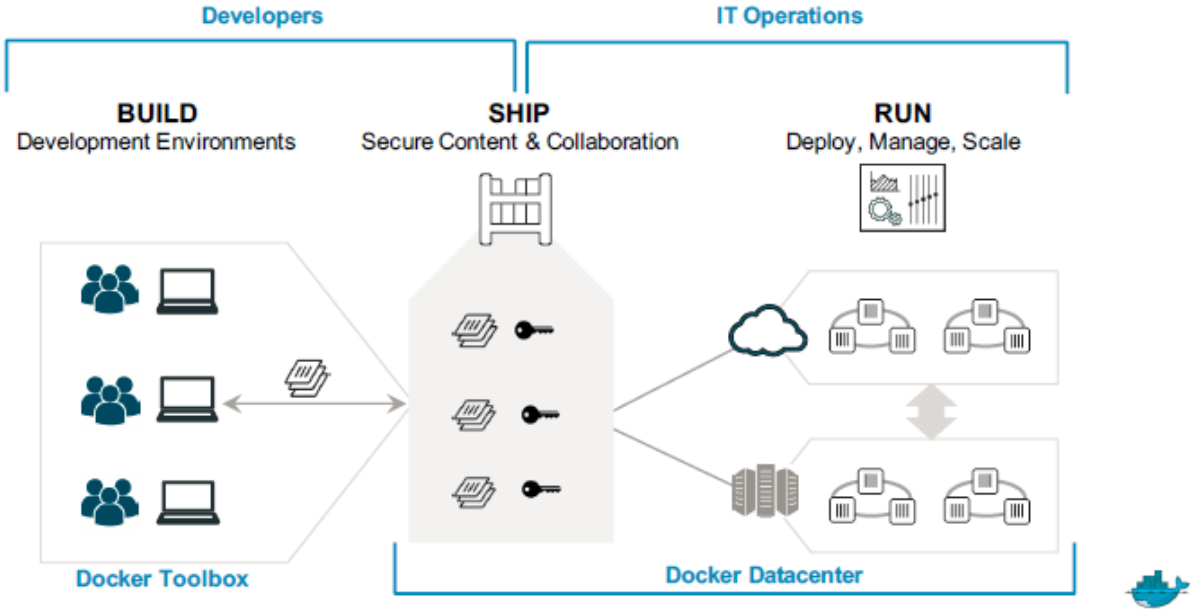
- Better resources utilization
- Less overhead compare to VM
- Light compare to VM
- Very FAST START : No Boot
- No special hypervisor mode access required

=> could be nested without performance impact.

Docker : Concepts

- **Engine**: Runs on Linux, it provides the operating environment for Docker containers.
- **Image:** Read-only templates for containers, stored and managed in a registry.
  Once instantiated a container is created.
- **Dockerfile:** Defines a Docker image as if it was code; used to re-build an image
- **Registry:** A service that allows to store and manage Docker images
- **Container:** Standard unit to package an application and its dependencies: binaries, libraries, system tools…
  So that it can be moved between environments and run without changes.

Containers & DevOps



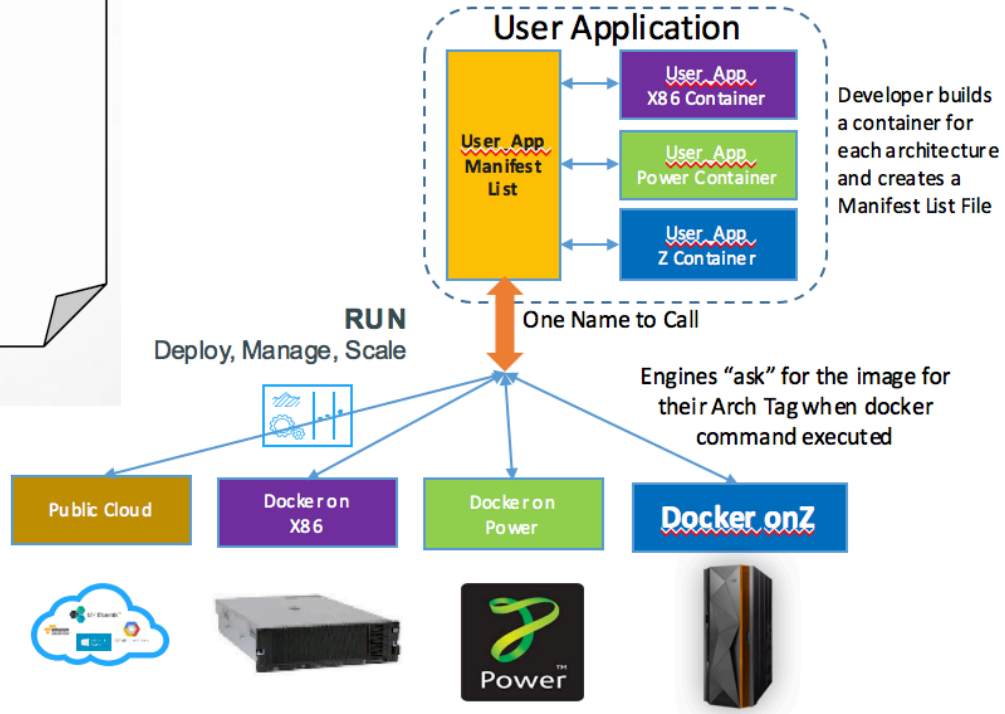
DevOps: Break down barriers between Dev and Ops teams to improve the app development process

CI/CD: Enable developers to develop and test applications more quickly and within any environment

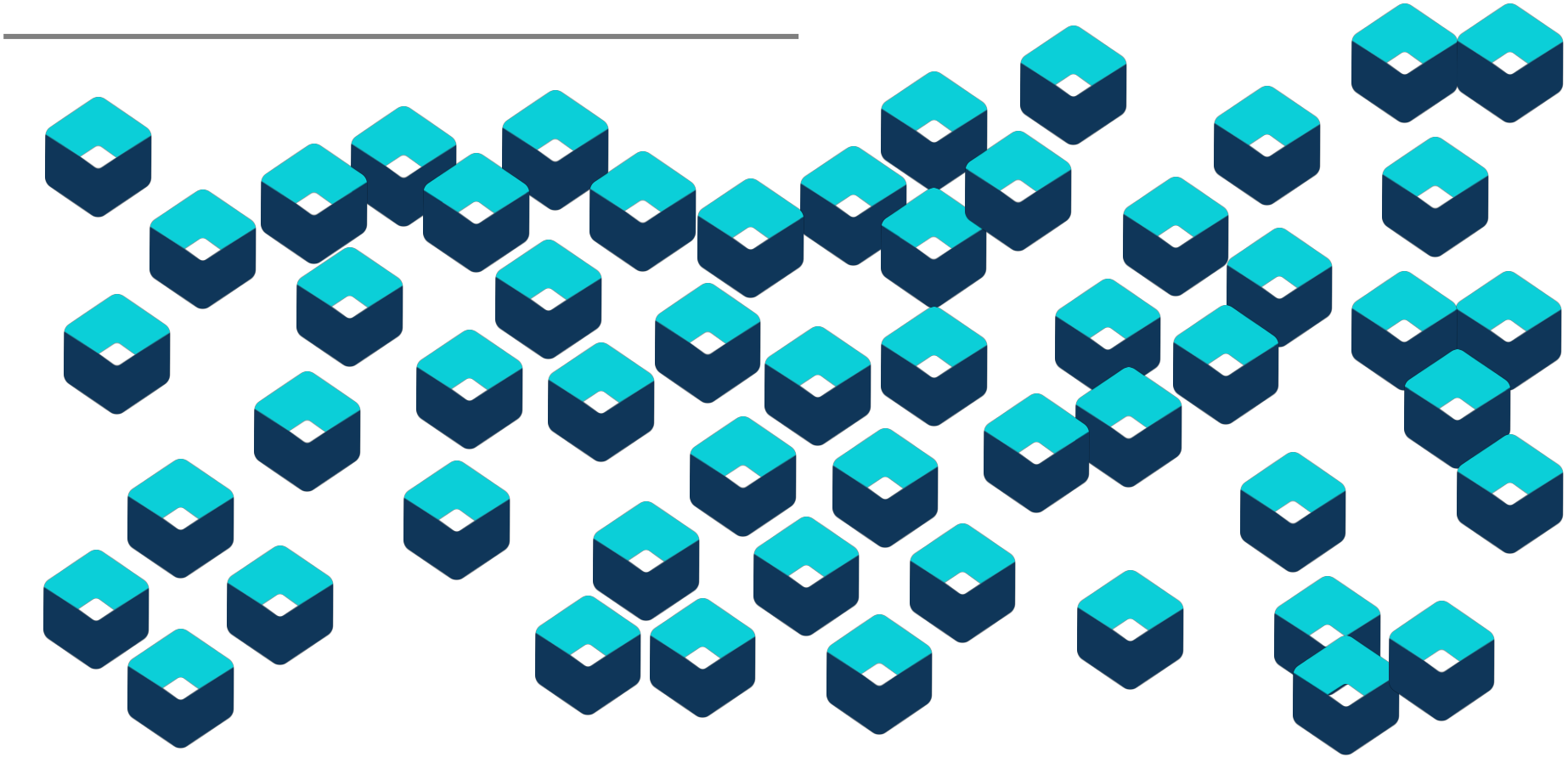
Multi-Arch & Multi-Cloud Enablement for Docker

```
From ubuntu:14.04

RUN apt-get install <your_app>

ADD <files like conf>

EXPOSE <tcp/udp port>

CMD <start_your_app>
```

Dockerfile example



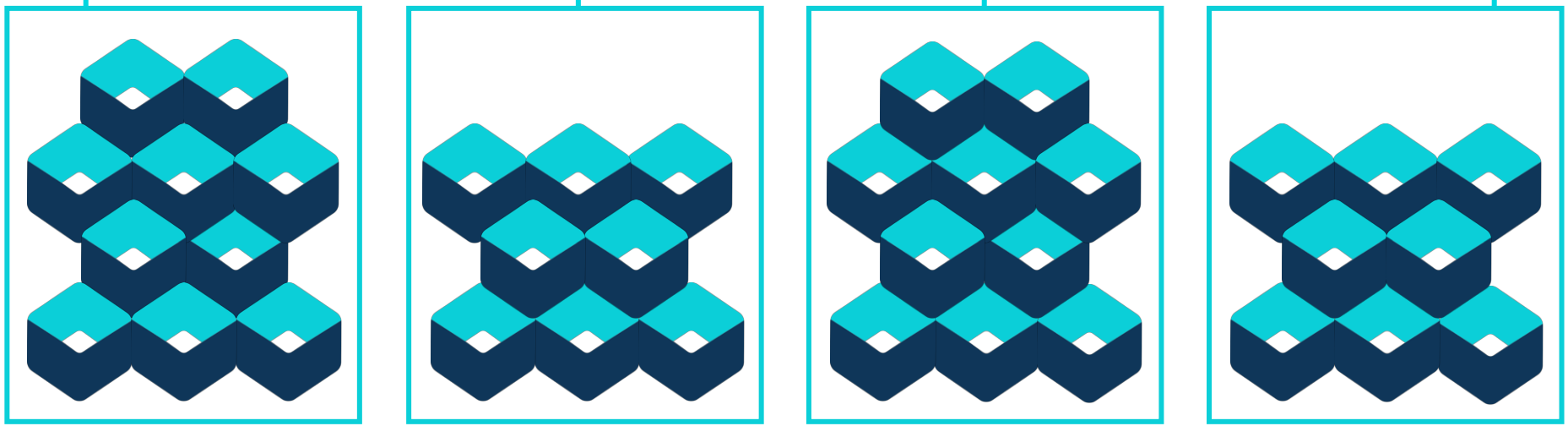
Containers are great but … can lead into lack of control & chaos



Kubernetes – (Κυβερνήτης - Captain in Greek)

Regain control with Containers and Kubernetes

- Organize and Govern the Container Chaos

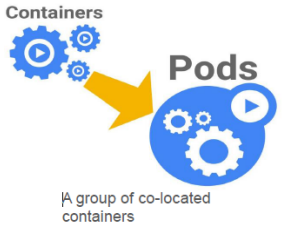


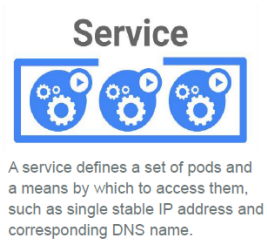
What do Kubernetes really offer ?

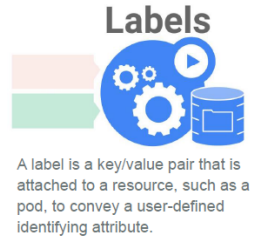
Intelligent Scheduling		Automatically places containers based on their resource requirements and other constraints, while not sacrificing availability. Mix critical and best-effort workloads in order to drive up utilization and save even more resources.
Self Healing		Restarts containers that fail, replaces and reschedules containers when nodes die, kills containers that don't respond to your user-defined health check, and doesn't advertise them to clients until they are ready to serve.
Horizontal Scaling		Scale your application up and down with a simple command, with a UI, or automatically based on CPU usage.
Service Discovery and Load Balancing		No need to modify your application to use an unfamiliar service discovery mechanism. Kubernetes gives containers their own IP addresses and a single DNS name for a set of containers, and can load-balance across them.
Automated rollout and rollback		Kubernetes progressively rolls out changes to your application, while monitoring application health to ensure it doesn't kill all your instances at the same time. If something goes wrong, Kubernetes will rollback the change for you. Take advantage of a growing ecosystem of deployment solutions.
Secret and configuration management		Deploy and update secrets and application configuration without rebuilding your image and without exposing secrets in your stack configuration.

Kubernetes Concepts

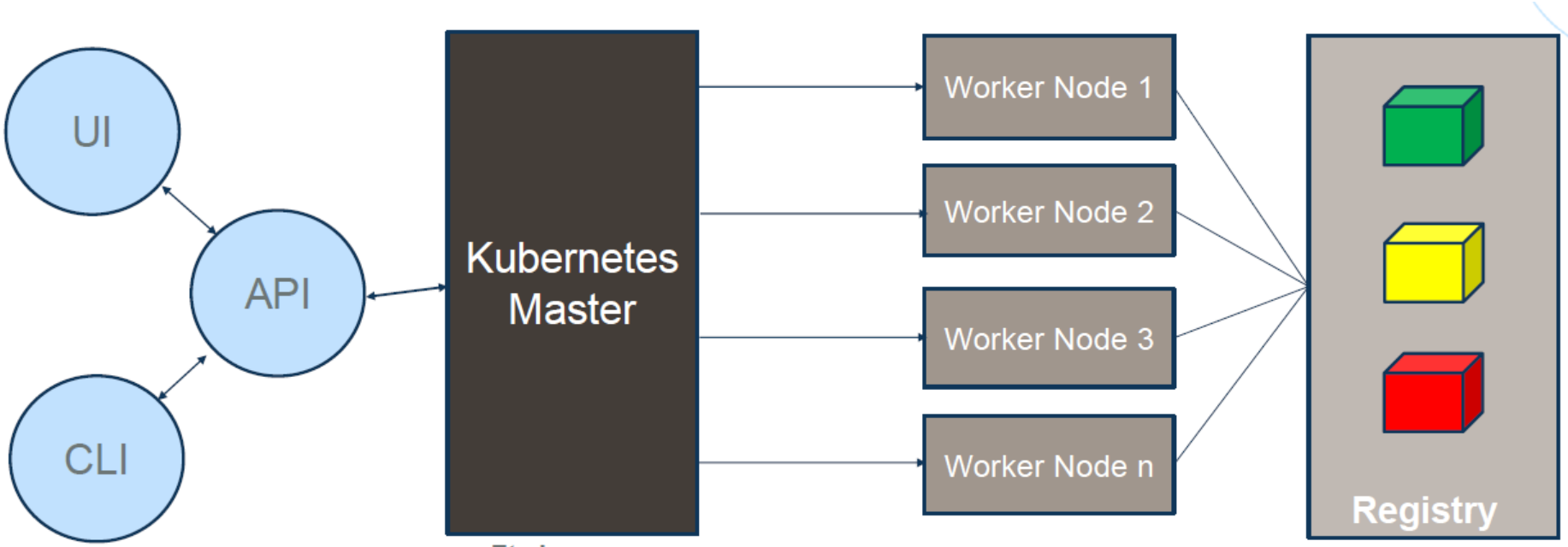
- Declarative Configuration (YAML) & Decoupling
  - Services, loosely coupled apps
- Consistency / Scaling
  - Application SLA vs. OS SLA
- Abstraction layer
  - K8s is present in all Cloud Provide
  - Pods, or groups of containers =
  - Kubernetes services =
  - Namespaces =
- Efficiency
  - Machine usage optimization – distribution of application







Kubernetes Architecture



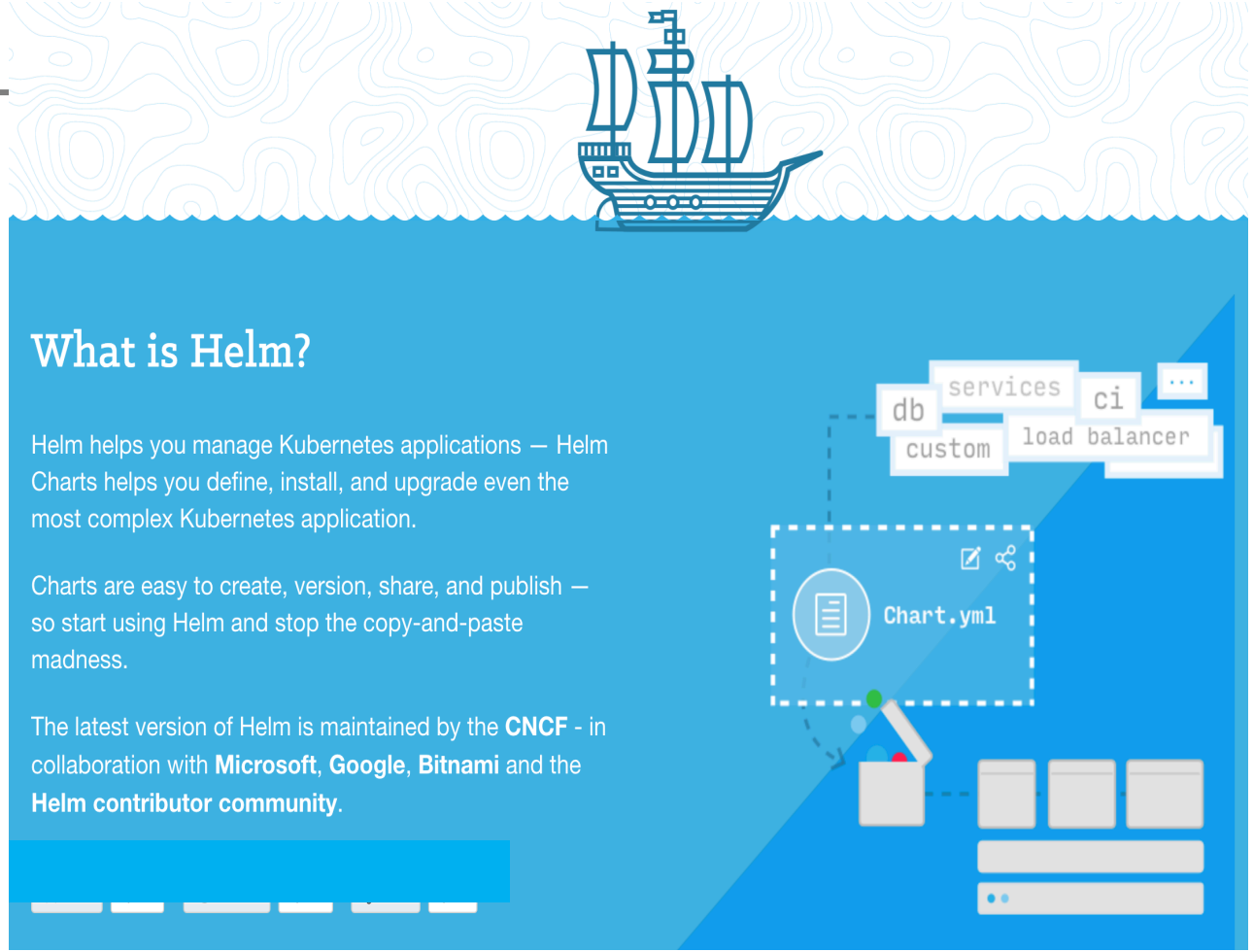
- Etcd
- API Server
- Controller Manager Server
- Scheduler Server

And HELM is …

The package manager for Kubernetes

Helm is the best way to find, share, and use software built for Kubernetes.

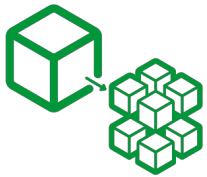
Tells Kubernetes all it needs to know about an application its parameters and dependencies

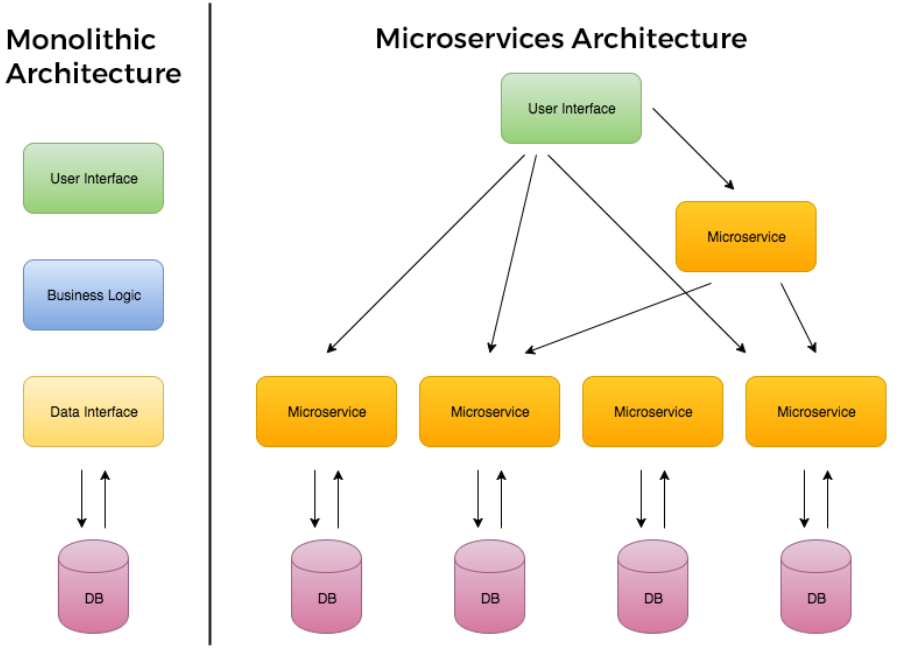


Microservices

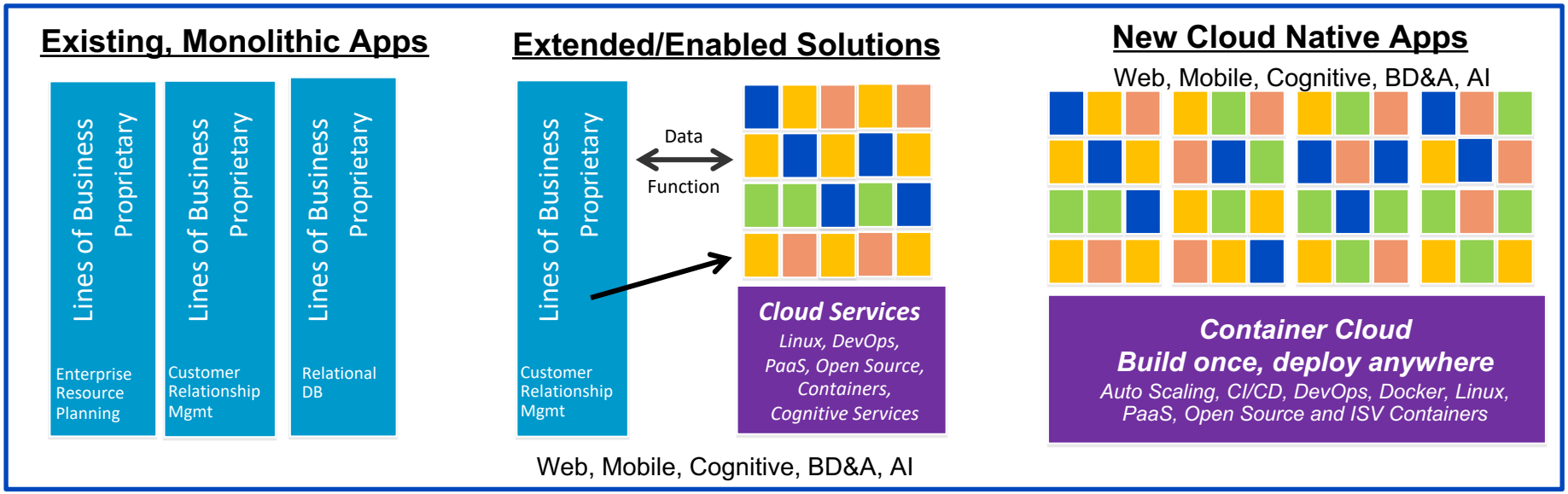
Microservice Approach

Microservices & Cloud Native Apps





Cloud is changing how workloads are built and delivered



Goldman Sachs Shifts to Docker

… a yearlong project that will shift about 90% of the company's computing to containers, according to Mr. Duet. That includes all of the applications, nearly 5,000 in total, that run on its internal cloud.

THE WALL STREET JOURNAL.
2/24/16

By 2018, Over **60%** of New Apps Will Use **Cloud-Enabled** Continuous Delivery and **Cloud-Native Application** Architectures to Enable Faster Innovation and Business Agility. ***IDC Predicts***

Why microservices?

The microservices revolution

Connecting people and digital apps better than ever before

A microservices architecture is gaining traction for developing and delivering cloud-native workloads across public, private, and hybrid application environments

60% of new apps will use cloud-enabled continuous delivery and cloud-native application architectures to enable faster innovation and business agility*

IDC FutureScape: Worldwide Cloud 2016 Predictions – Master the Raw Material of Digital Transformation, November 2015

Why?

- ✓ Decomposed into small pieces
- ✓ Loosely coupled
- ✓ Easier to scale development
- ✓ Improved fault isolation
- ✓ Each service can be developed and deployed independently
- ✓ Eliminates any long-term commitment to a technology stack

I. Codebase
One codebase tracked in revision control, many deploys
II. Dependencies
Explicitly declare and isolate dependencies
III. Config
Store config in the environment
IV. Backing services
Treat backing services as attached resources
V. Build, release, run
Strictly separate build and run stages
VI. Processes
Execute the app as one or more stateless processes
VII. Port binding
Export services via port binding
VIII. Concurrency
Scale out via the process model
IX. Disposability
Maximize robustness with fast startup and graceful shutdown
X. Dev/prod parity
Keep development, staging, and production as similar as possible
XI. Logs
Treat logs as event streams
XII. Admin processes
Run admin/management tasks as one-off processes

Why 12 factor apps?

https://12factor.net/

Code

I. Codebase
One codebase tracked in revision control, many deploys

V. Build, release, run
Strictly separate build and run stages

X. Dev/prod parity
Keep development, staging, and production as similar as possible

Deploy

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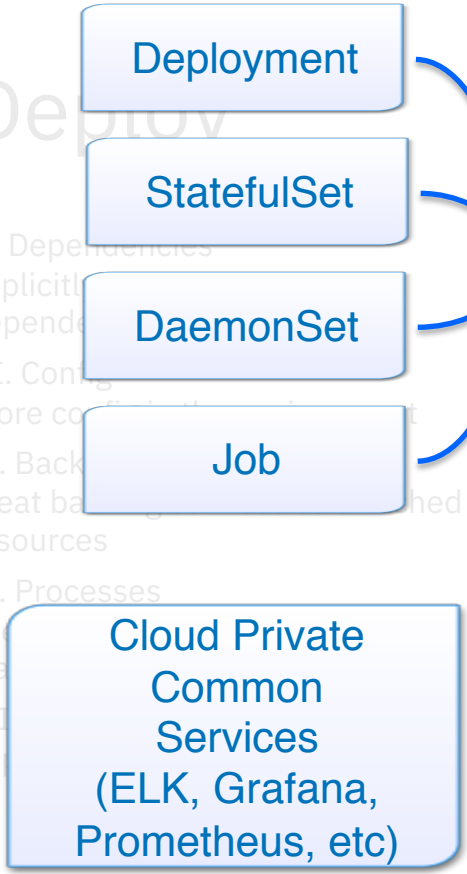

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IBM Cloud Private

IBM Cloud Private

- A private cloud platform for enterprises to develop and run their workloads locally
- An integrated platform consisting of PaaS and developer services necessary to create, run, and manage cloud applications
- Container infrastructure, orchestration and management
  - ✓ Resource management
  - ✓ Application life-cycle management/schedule/deployment
  - ✓ Scaling, rolling upgrade
  - ✓ Service registry/discovery
  - ✓ Distributed storage management
  - ✓ Image/software repository management
  - ✓ Configuration management
  - ✓ User/Account management

kubernetes

Kubernetes based container platform

Industry leading container orchestration platform

Common Services

Simplify operations management, DevOps, and hybrid integration

IBM Middleware, Data and Analytics services

Optimize current investments and rapidly innovate

Built with open standards
preventing vendor lock-in

Executable package of software that includes everything needed to run it

Containers

Automate deployment, scaling, and management of containerized applications

Orchestration

Define, install, and upgrade Kubernetes applications

Management

Infrastructure as code to provision public cloud and on-premises environments

Provisioning

IBM Cloud Private Solution Overview

Enterprise Content Catalog of IBM Middleware, Open Source: e.g. Data, Analytics, Developer Services

Cloud-enabled middleware, application runtimes, messaging, databases & analytics to optimize current investments and rapidly innovate

IBM WebSphere · IBM MQ · IBM Db2 · IBM Data Science Experience · open source · EDB POSTGRES · PostgreSQL

Core Operational Services

To simplify Operations Management, Security, DevOps, and hybrid integration

Cloud Automation Manager

Infrastructure as Code for multi-cloud provisioning to public and on-premises private clouds

Terraform · IBM Cloud Automation Manager

Kubernetes-based Container Platform

Industry leading container orchestration platform

kubernetes · HELM

App Catalog

Easily launch applications

Runs on existing IaaS: vmware · openstack · NUTANIX Your Enterprise Cloud Platform · OpenPOWER · Power Systems · System Z · IBM Spectrum · Dell, Cisco, NetApp, Lenovo, …

IBM Cloud Private – Specific Use Cases

Use Case #1

Modernize and optimize existing applications

- Time to market acceleration
- Legacy or monolithic apps
- Existing WAS, MQ, DB2 infrastructure / migration
- DevOps initiatives and enterprise developers
- x86, Power and zLinux

Use Case #2

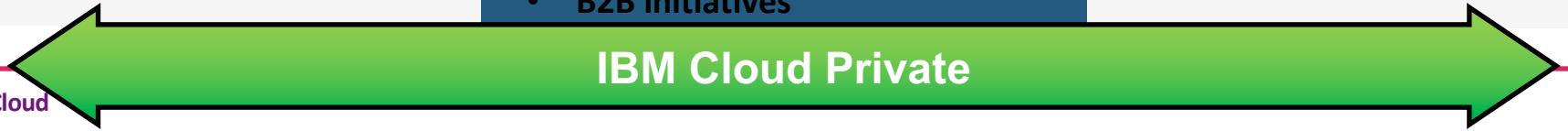
Opening up enterprise data centers to work with cloud services

- Securely open your datacenter
- GDPR
- API Economy
- Integrate public cloud services securely with your local cloud
- new web/mobile presence
- customer loyalty
- B2B initiatives

Use Case #3

Create new cloud-native applications

- New use cases
- IoT
- Blockchain
- Machine Learning
- Data science experience
- Building MicroServices



IBM Cloud Private Editions

Community

Platform
- Kubernetes (+ Helm)
- Core services
- Content catalog (Containers)

Freely Available in Docker Hub

Cloud Native

Platform
- Kubernetes (+ Helm)
- Core services
- Content catalog (Containers)

Cloud Foundry (Optional)

IBM Enterprise Software
- Microservice Builder
- WebSphere Liberty
- IBM SDK for node.js
- Cloud Automation Manager

Enterprise

Platform
- Kubernetes (+Helm)
- Core services
- Content catalog (Containers)

Cloud Foundry (Optional)

IBM Enterprise Software
Cloud Native Edition, plus:
+ WAS ND
+ MQ Advanced
+ API Connect Professional

IBM Cloud Private – Packaging and Purchasing Options

New!

Community	Power Systems Entry for ICP bundle*	Cloud Native	Enterprise	ICP Software Bundle "Paks"

Common Core Platform Services
- Kubernetes (+ Helm)
- Core services
- Discover and Try Content catalog (Containers)

Freely available in Docker Hub

- Entitles clients to Dev/ Test only, not for use in production
- High Available (HA) not available
- Best effort support by ICP and community teams
- Same code base as Cloud Native edition

Client Supplied and Trial Version Software

- Entitles clients to Dev/Test, Production and HA
- Low entry cost; 12-month term
- Support included
- Available when ordered with Power servers
- Special upgrade price to Cloud Native at end of term
- Available in AAS

IBM Enterprise Software

- Nominal upgrade from Entry
- Ability to convert to perpetual license
- Includes Cloud Automation Manager and other IBM Software
- Available in PPA

IBM Enterprise Software

Cloud Native Edition, plus:
- WAS ND
- MQ Advanced
- API Connect Professional

- Available in PPA

IBM software packages delivered as containers with Cloud Private as their "delivery and management" platform

* Available only when included with IBM Power Systems servers

Low Cost Private Cloud Entry Point for Power Clients

- "Starter" environment for modern multi-Cloud platform available with Power Systems servers
- Fully supported by IBM (7x24) including HA
- Easily add new ICP software editions / Paks
- Low cost upgrade to Cloud Native Edition

IBM Power Systems Entry for Cloud Private

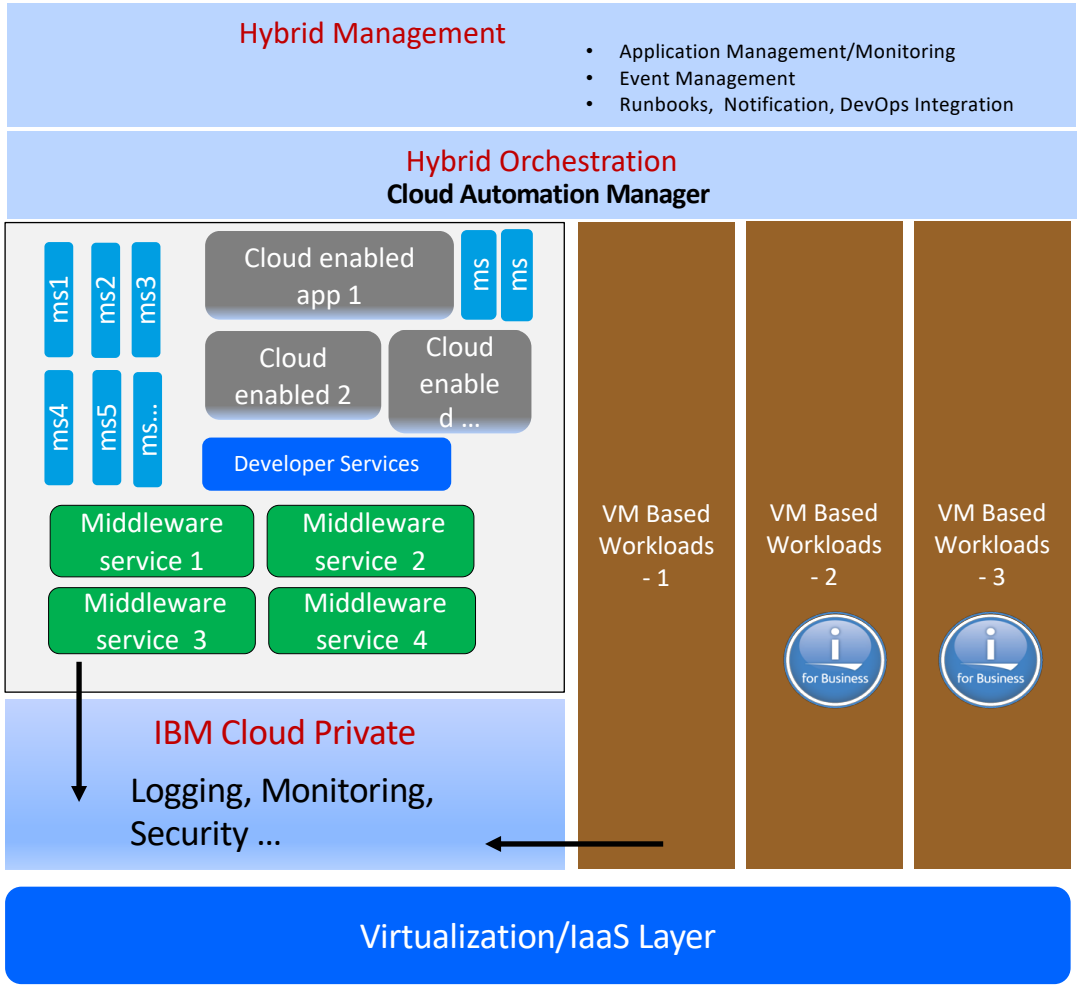
New!

- A small-scale Power server hardware + software platform for clients to test and learn about IBM Cloud Private, Kubernetes and micro-services
- Available when ordered with an IBM Power Systems server
- Supported on all classes of Power servers
  - Power Systems Enterprise servers
  - IBM Hyperconverged powered by Nutanix
  - Power Systems scale out servers
- Includes all core platform services

(IBM Cloud) ^ POWER9

- Entitles client to Cloud Private platform services for 32 worker node cores, 1 management node and 3 HA masters
- Provides 7x24 IBM support including production and HA environments
- Discounted upgrade to Cloud Native available at end of 12 months available

The Architect's view : ICP + Cloud Automation Manager



Cloud Native application logic (Innovating)

- Microservices

Middleware Services (some IBM and some from the open source world)

- Each instance supports 1..n microservices
- IIB, DB2, Open Databases like Redis, Mongo, Messaging, API C, Datapower

Cloud Enabled (Modernizing)

- Monolithic applications made to run in containers
- Brought from WAS ND or WAS Base to Liberty

Add new function, expose APIs

VM Based Workloads

- WAS Base, WAS ND, BPM and others as necessary, CAM provisioned

All holistically plugged into existing Enterprise Facilities for Management, Monitoring and Security

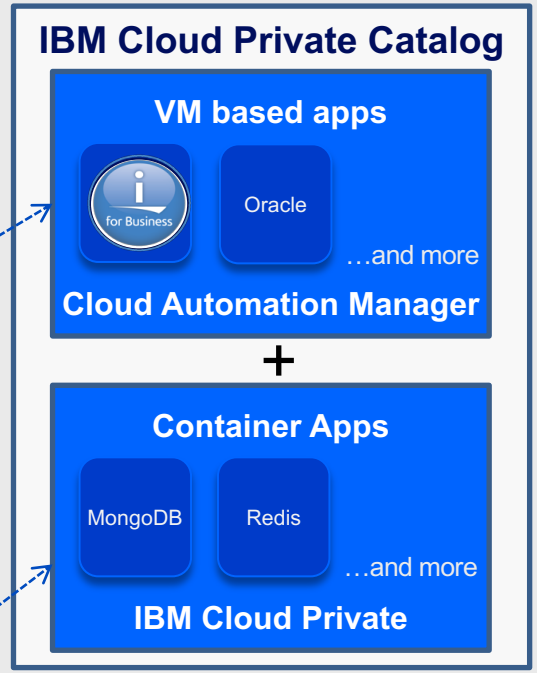
Cloud Enable your Mission Critical Applications
including existing applications running on AIX and IBM i

Traditional Enterprise Apps

WebSphere App Srv
WebSphere MQ
SAP R/3
Oracle
Db2
+++

Container Apps

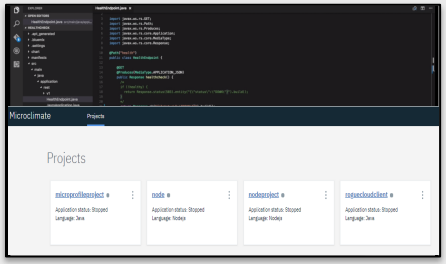
WebSphere Liberty
MongoDB
Redis
Jenkins
+++



- Deploy existing ***VM-based applications*** in a multi-cloud environment with **Cloud Automation Manager (CAM)**
- Add any **AIX, IBM i, or Linux VM**-based application to the Cloud Private catalog
- Integrate new services with existing mission critical workloads (e.g. DBs), achieving a *single catalog* and **coordinated orchestration**
- Deploy and manage applications with a **common self-service interface,** seamlessly align workloads to most optimized infrastructure
- Manage **integrated clusters** of Power, z/LinuxONE, and Intel servers

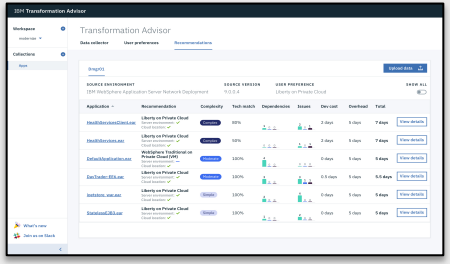
Microclimate – Part of the Solution to Accelerate Modernization

https://microclimate.dev/



Microclimate

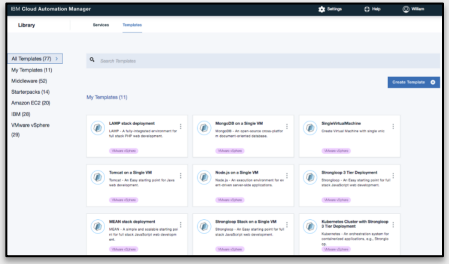
End-to-End Development Experience



Transformation Advisor

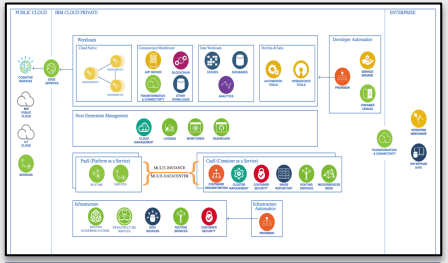
Assess and Plan

Prescriptive Guidance



Cloud Automation Manager

Multi-Cloud Provisioning and management



IBM Cloud Garage

Best Practices

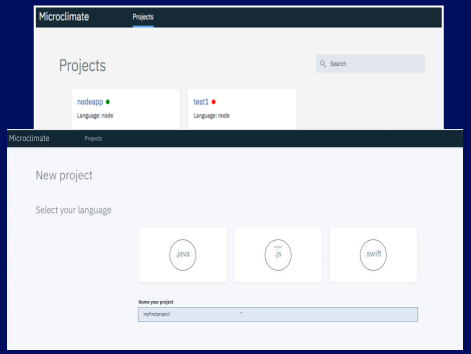
Reference Architectures

IBM Microclimate

microclimate-dev2ops.github.io

An integrated development environment for building cloud native applications

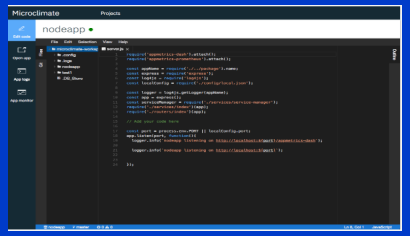
Rapid onboarding and app creation



Run Locally or via Catalog on ICP

docker

Web-based IDE supporting full lifecycle, or BYOE



Included web IDE, or bring your own

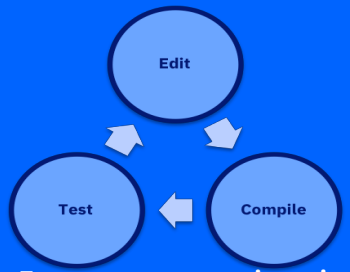
VS Code

ORION

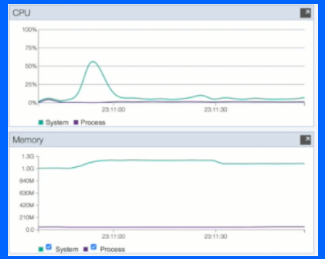
Powered by

Language Server Protocol (LSP)

Rapid dev cycle (Inner Loop)

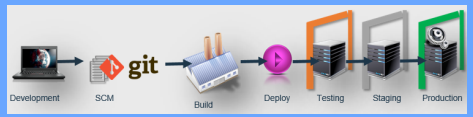


Instant monitoring & feedback

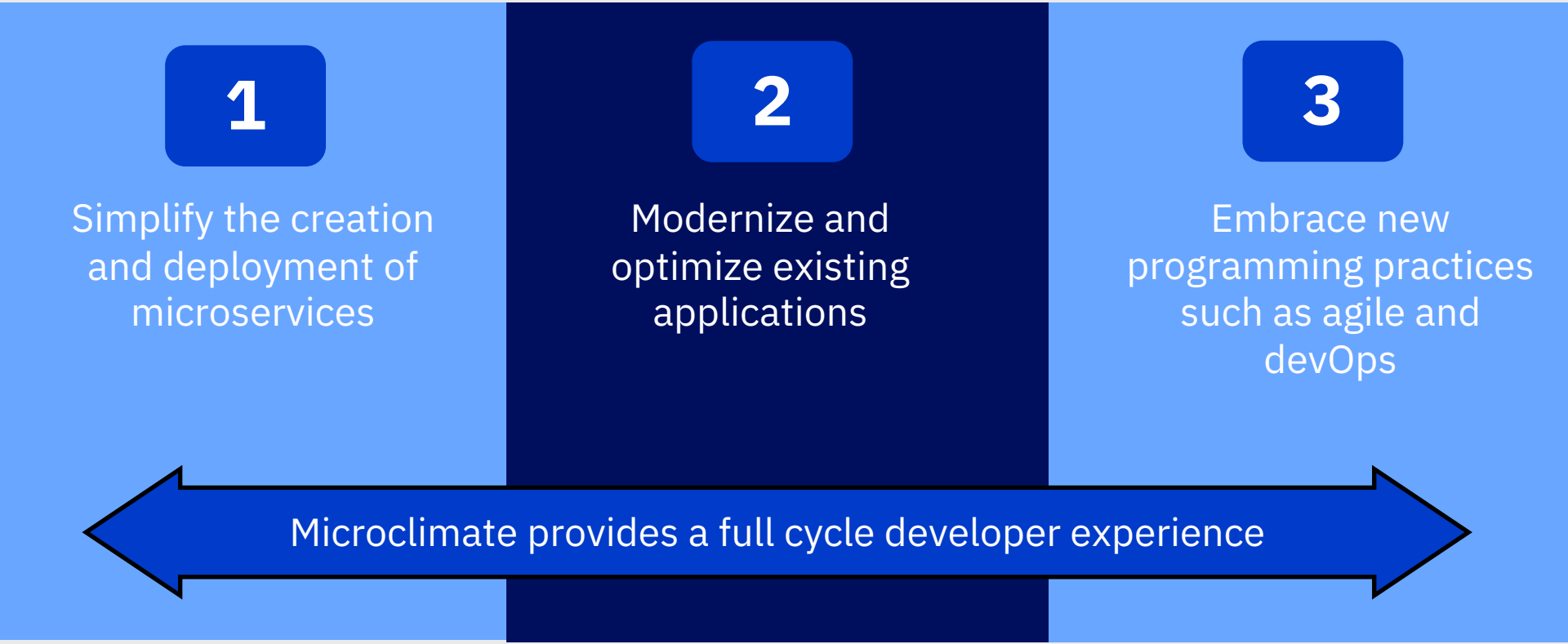


DevOps Pipeline

Get into production fast with a preconfigured DevOps pipeline



Microclimate: Key use cases



Microclimate scope

Dev Portal

Developer Access
Manage Applications
DevOps Tool Chain
Launch & Manage
Microclimate Dev Tools

Create Services

App Generation
Enable and Upgrade Existing
Zero Migration Services
Template to App conversion

Inner Loop Services

Language Server Protocol Support (Polyglot, BYOE)
Incremental Build for fast dev cycles
Integrated Performance Monitoring
Integrated Environment Setup and Configuration

Dev Ops Pipeline

Automated Jenkins Build and Deploy Pipeline
Git integration
ICP Kubernetes Deployment
Devops Integration for Disconnected operation

Local Dev Env(s)

Browser based IDE

CLI Integrations (Maven)

VS Code

eclipse

Local IDEs

DevOps Integrations

git SCM

Registry

artifactory Repository

Integrations for Disconnected Operation

Legend:

ICP	Microclimate Local or ICP	Option for 3rd Party

IBM Cloud Private & IBM i

IBM i Apps & Cloud Native Apps

- ICP = based on Open Standards , for creating & deploying quickly new apps & new micro-services
- Need to complement this solution with a “DevOps” approach (automation, test..)
  - CI/CD : Microclimate, DevOps solutions for IBM i, …
- On the IBM i side , a few Challenges :
  1. Existing Apps understanding
  2. Modernize my Apps, good practices for the existing & new ones
     - Rewriting vs. Refactoring
     - Data Centric Approach – Use Db2 for i & OS features,…
     - Modular Design vs. Architectural Monolith
     - **DevOps** Approach– Toolchain CI/CD (mandatory?) integrating your **IBM i environment**.
  3. IBM i Integration with Cloud Native Apps
     - Open Source Tools & frameworks on IBM i.
     - Expose your apps & data on IBM i via standards - Web Services & API / Microservices on IBM i

Factors	Refactor	Re-write
Risk of losing the market	+	−
Accumulated knowledge	+	−
State-of-the-art technology	−	+

Factors to consider while deciding between refactor and re-write

IBM i Apps & Cloud Native Apps

- Why a modular approach / micro services on IBM i ?
  - Collaborative devs & application integration made easier
  - Time saver for innovative projects & frequent apps changes & enhancements
  - Relevant for pure IBM i devs (RPG ILE, Java, Node.js, PHP) or hybrid (IBM i + Cloud).

- Part of a global **DevOps** methodology & mindset **, for any Cloud Apps (SoE) & IBM i Apps**
  → requires a DevOps mindset…and appropriate tooling : **Toolchain, Delivery Pipeline**
  → IBM Solutions , Open Source & Third Party

IBM i Apps & Cloud Native Apps

Architectural Evolution

Spaghetti Architecture

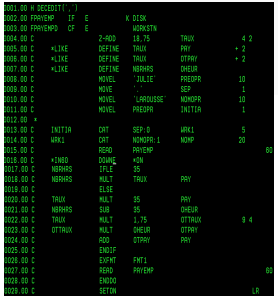
Cut & Paste
(1990's)

Lasagna Architecture

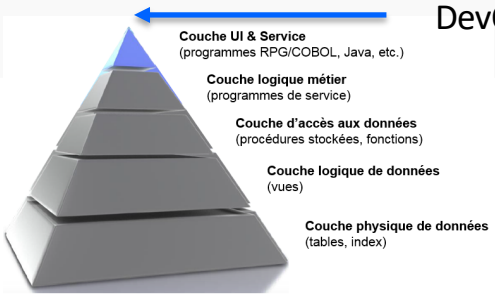
Layered Monolith
(2000's)

Ravioli Architecture

Microservices
(2010's)

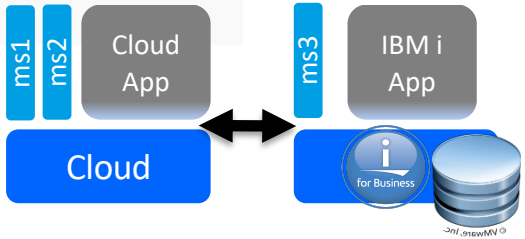


App Centric Monolith,
Single Program



Data Centric, Modular & Layered, Modern Techno, Design Patterns (MVC…)

DevOps Ready



IBM i Apps & Cloud Native Apps

Everything is ready for building Cloud Native & Microservices solutions integrated with any IBM i applications:

- ❑ New languages & frameworks on IBM i : RPG Free, Python, Ruby, Node.js and many others (.NET) etc.

- ❑ Out of the box Integration technologies available on IBM i
  - Integrated Web Service Server (WebSphere Liberty)
  - Integrated Application Server (WebSphere Liberty)
  - Open Source frameworks (Node.js, NGINX) with native access to objects & the database

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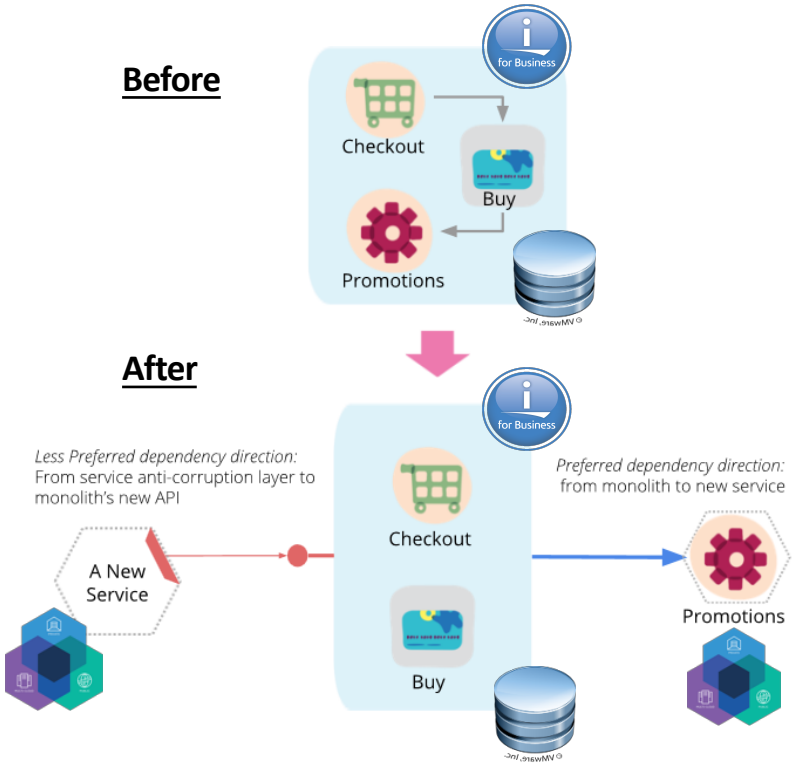
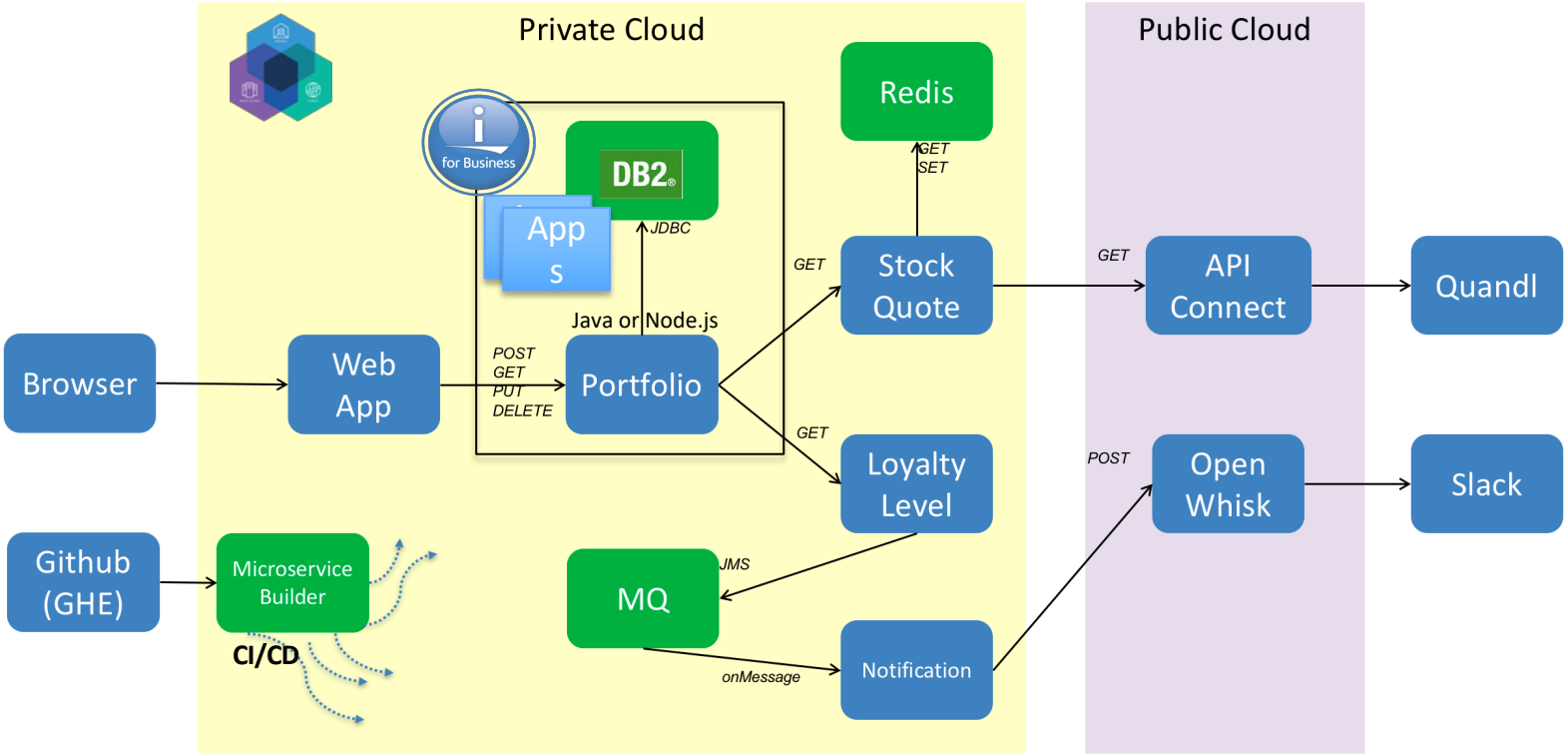


IBM i Apps & Cloud Native Apps

micro-services Application w/ IBM I integration

Stock Trader App

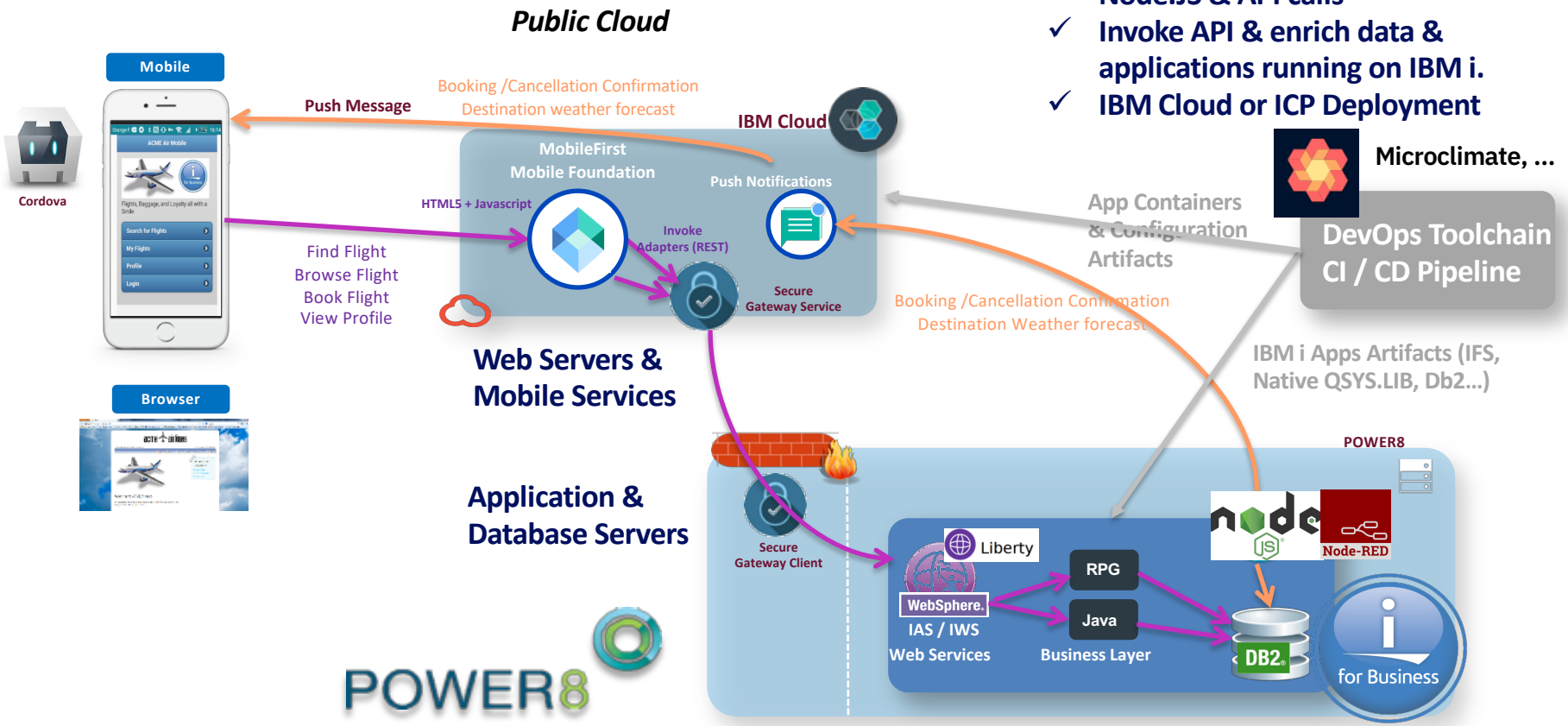


Original source: https://github.com/IBMStockTrader/

Example: Develop new Mobile Services on IBM i with IBM Cloud

Hybrid Application – DevOps & Microservices

- ✓ Micro-Service Approach using Node.JS & API calls
- ✓ Invoke API & enrich data & applications running on IBM i.
- ✓ IBM Cloud or ICP Deployment



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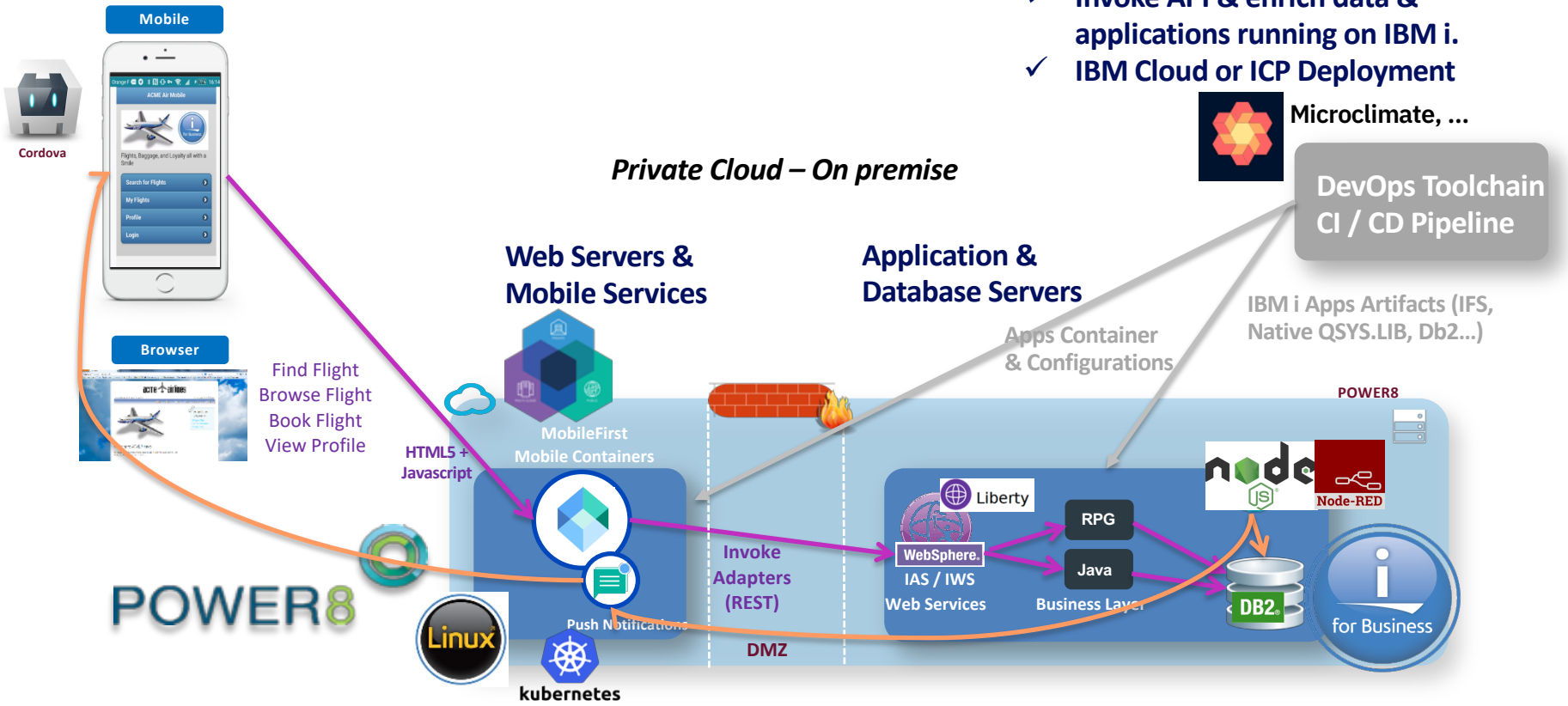

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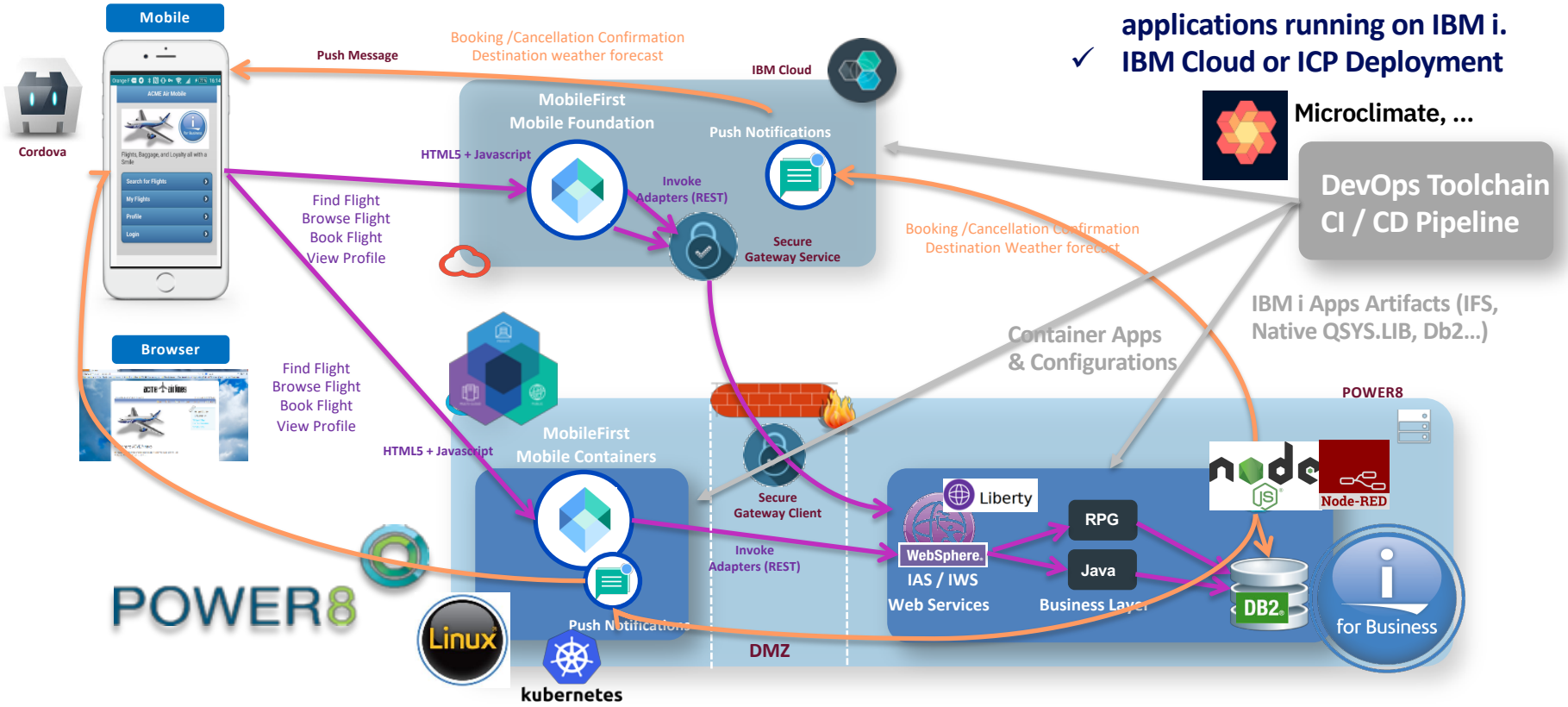


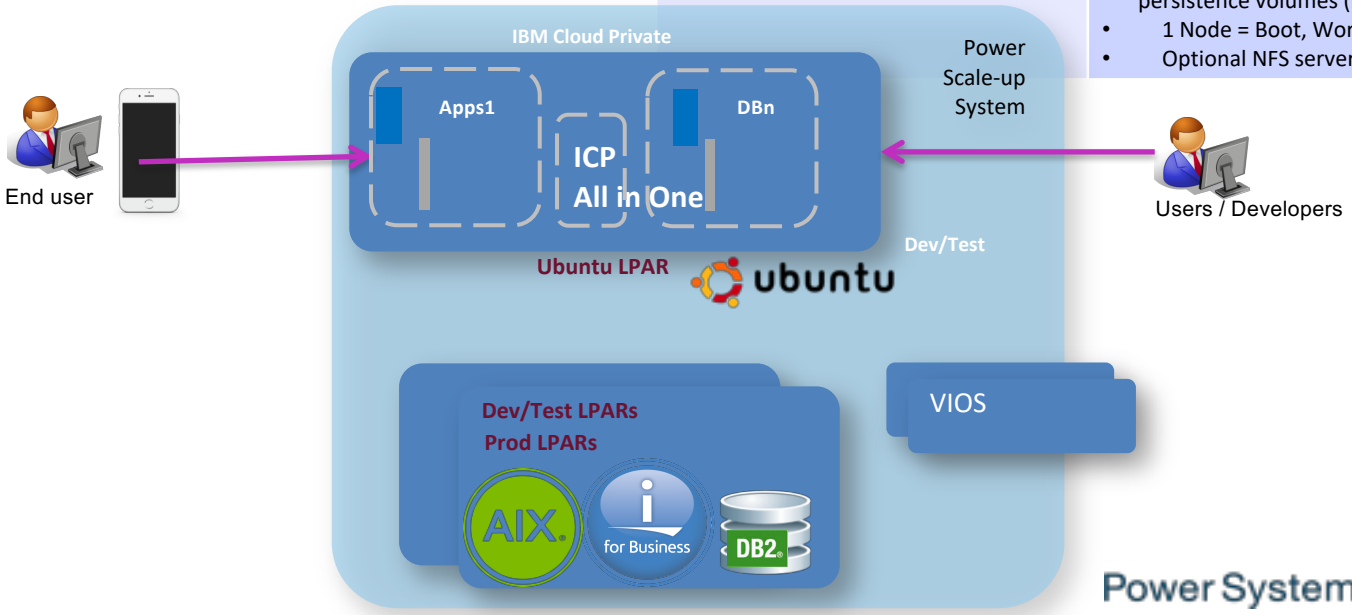
How to get Started?

Starter configuration – Single node “All in one”

- **CE (Free) Edition. For Dev/Test, no HA.**
- Cloud or Enterprise Editions = catalog++
- ICP on PowerVM (LPAR) or 1 Scale-out L / LC / CS System (VM)
- Cloud Foundry on x86 nodes only (1H 2018)

Current	Target*
IBM i / AIX / Linux LPARs production	IBM i / AIX / Linux LPARs production
IBM i / AIX / Linux LPARs dev/test	IBM i / AIX / Linux LPARs dev/test

- **ICP 3.1 on Power Community Edition**
- **1 Node: LPAR Ubuntu 16.04 LTS**
- **8 core / 16GB / disk 200+ GB**
  Documentation: 4 cores / 8GB
- SAN Storage or internal disks
- hosted by VIOS (SAN/LAN), NFS Server for persistence volumes (need storage)
- 1 Node = Boot, Worker, Proxy, Master
- Optional NFS server for persistence

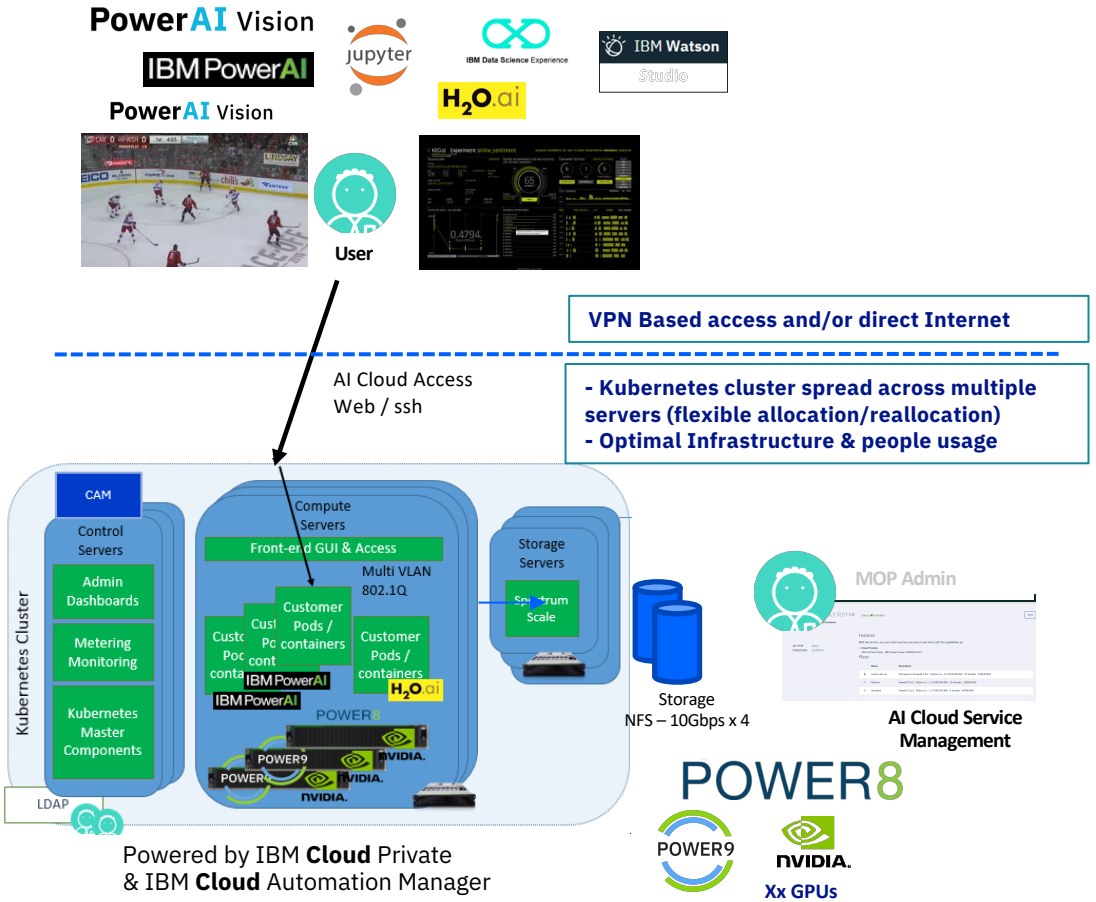


Demonstrations – App & Infrastructure Modernization

- ❑ IBM Cloud Private : Quick tour
  Private AI (GPU as a Service) & App modernization cloud with Kubernetes
- ❑ Automate IBM i provisioning with ICP, CAM , PowerVC
- ❑ Microclimate , CI / CD

Presentations & Video Replay https://ibm.biz/bma-wiki

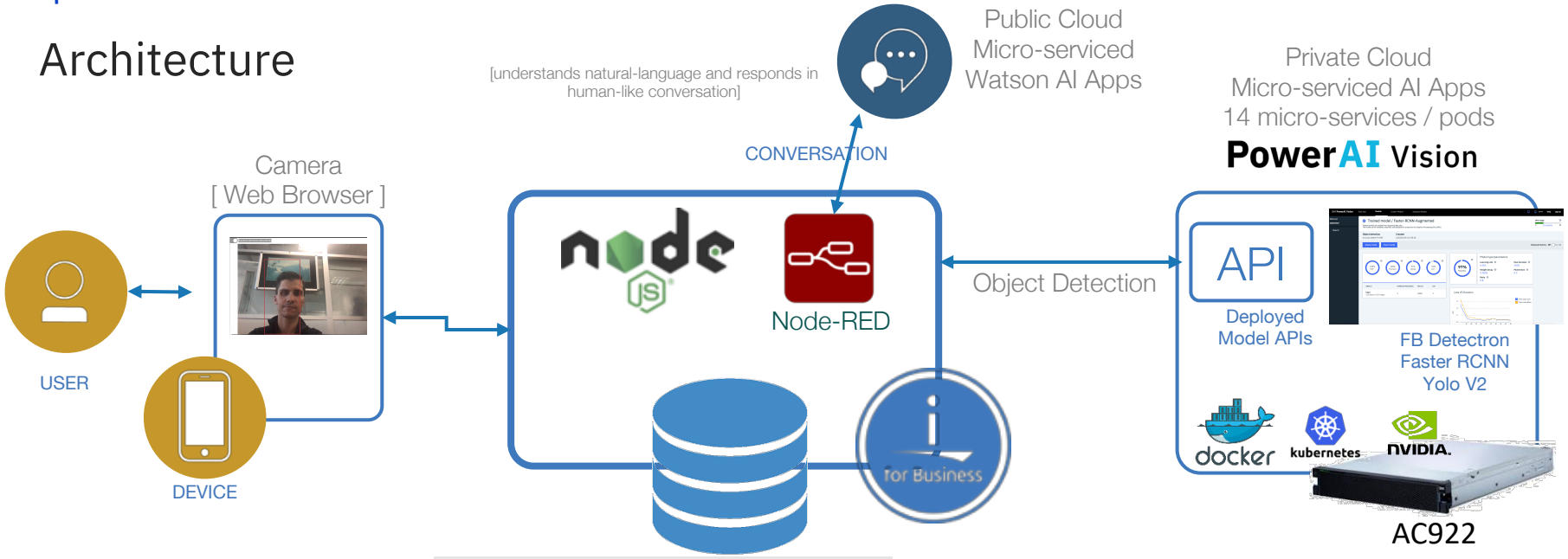
Demo Environment – Private AI Cluster



Demo 1 : Hybrid Application - IBM i + AI hosted on ICP/Kubernetes

Computer Vision with PowerAI Vision & IBM i

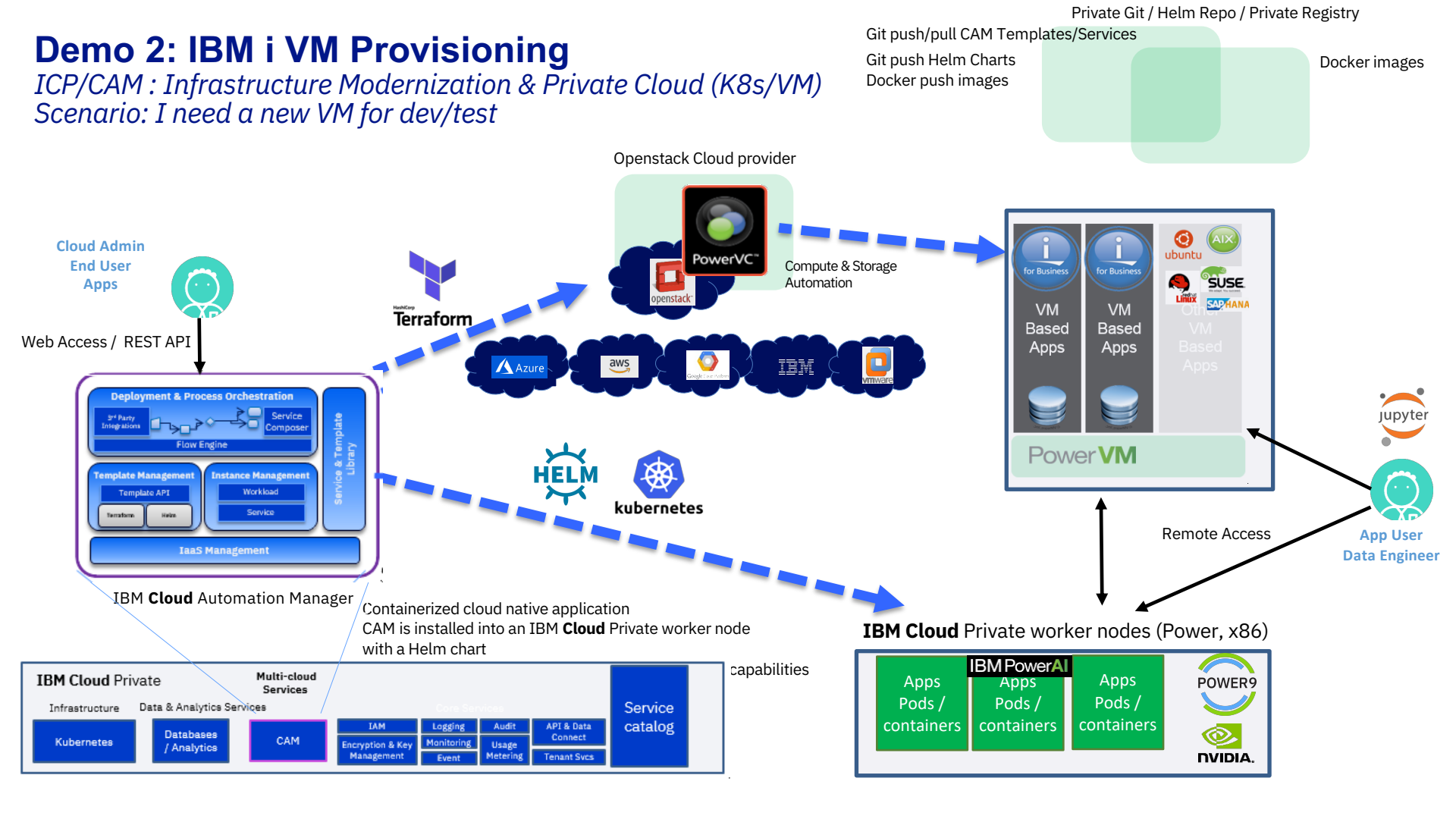
- Architecture



ID	DETECTEDLABEL	CONFIDENCE	YMAX	XMAX	XMIN	YMIN
165	head	0.995372474193573	119.0	111.0	73.0	36.0
164	head	0.9906670451164246	119.0	122.0	84.0	62.0
163	head	0.9786785244941711	119.0	157.0	123.0	60.0
162	head	0.998145580291748	119.0	101.0	53.0	54.0
161	head	0.9998226761817932	119.0	95.0	52.0	53.0
160	head	0.9996845722198486	119.0	104.0	61.0	53.0
159	head	0.9455117583274841	119.0	124.0	83.0	57.0
158	head	0.735583484172821	119.0	126.0	87.0	74.0
157	head	0.9001550674438477	119.0	119.0	84.0	63.0
156	head	0.6558237075805664	119.0	37.0	0.0	52.0
155	head	0.9980860948562622	119.0	45.0	3.0	39.0
154	head	0.9998077750205994	119.0	103.0	60.0	50.0

Demo 2: IBM i VM Provisioning

ICP/CAM : Infrastructure Modernization & Private Cloud (K8s/VM)
Scenario: I need a new VM for dev/test



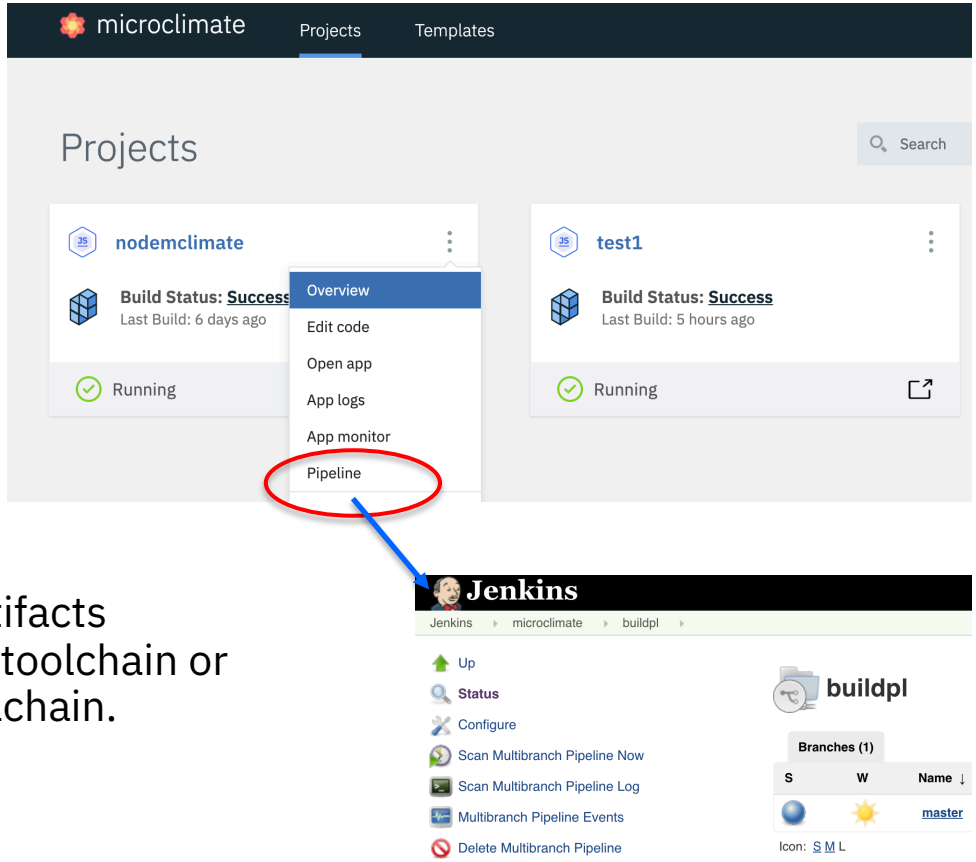
Demo 3 : Basic CI / CD Demo with Microclimate

1) Microclimate (free) can be installed on a desktop or on top of ICP:
→Demo with Microclimate on ICP

2) Includes Git & Jenkins for Automating tasks: build, deploy…
→ Source (git) to Image (container Image) build automation
→ Deployment in the K8s / ICP cluster

3) Access to the deployed application

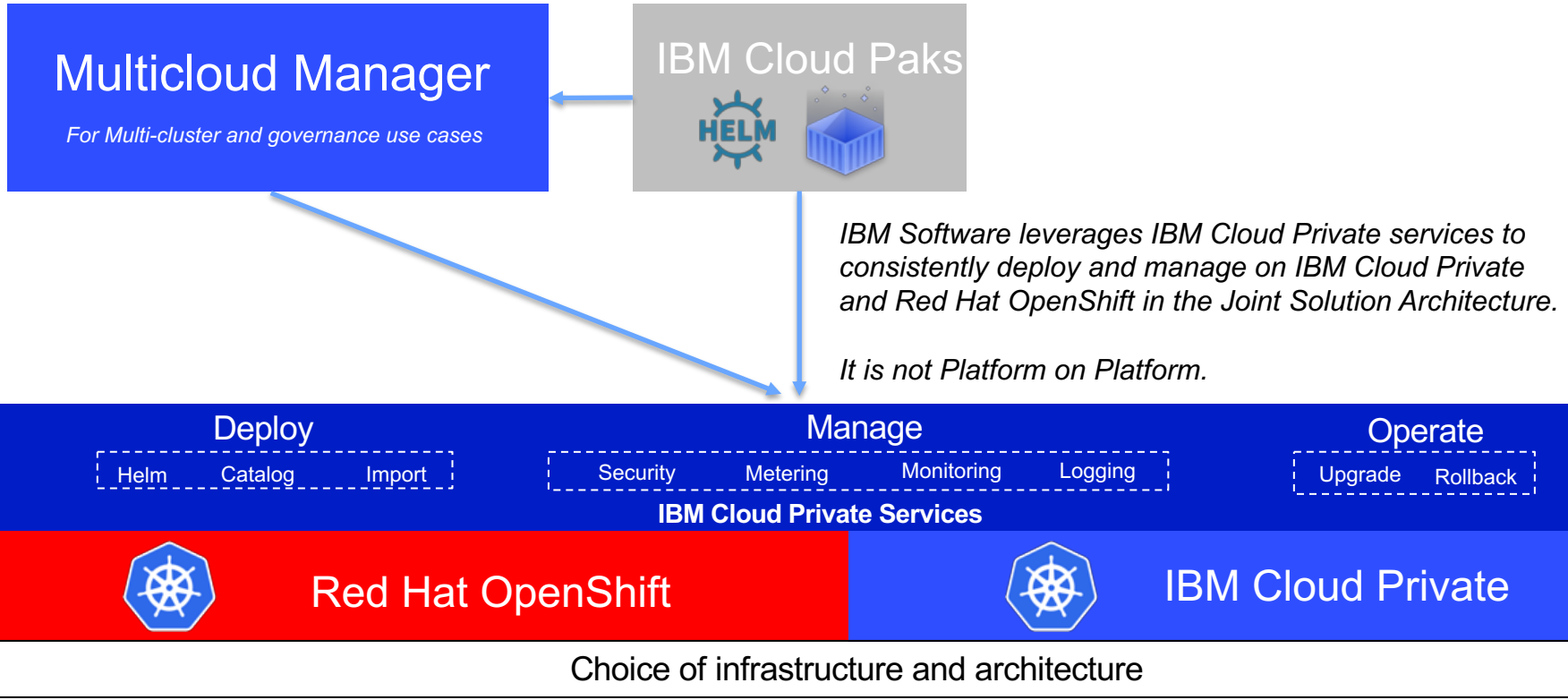
A next version of this demo would include artifacts & code for IBM i (ILE / PASE) using the same toolchain or integrated with an existing IBM i DevOps toolchain.
To be continued



thirty years

Backup Slides

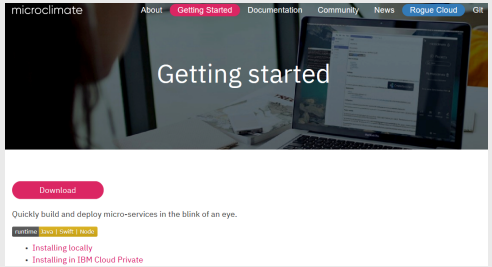
How it works today



Microclimate – Get started

Via Home Page

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



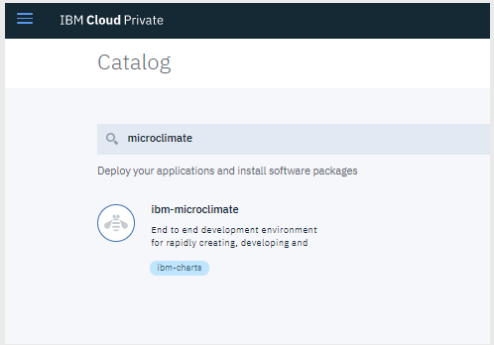
Freely Available

1. **Download from Microclimate Home Page to run locally (ILAN license)**

2. **Install into IBM Cloud private via ICP catalog (supported with ICP license)**

Use with IBM Cloud Private Community Edition

Via IBM Cloud Private Catalog



Digital Assets

Home Page

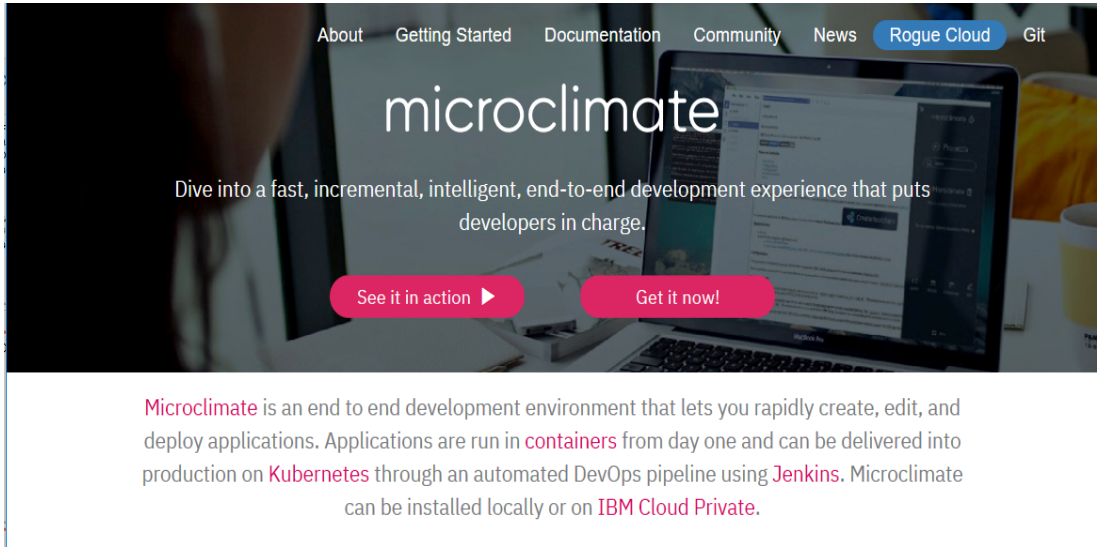
- Microclimate overview
- Intro videos
- Documentation

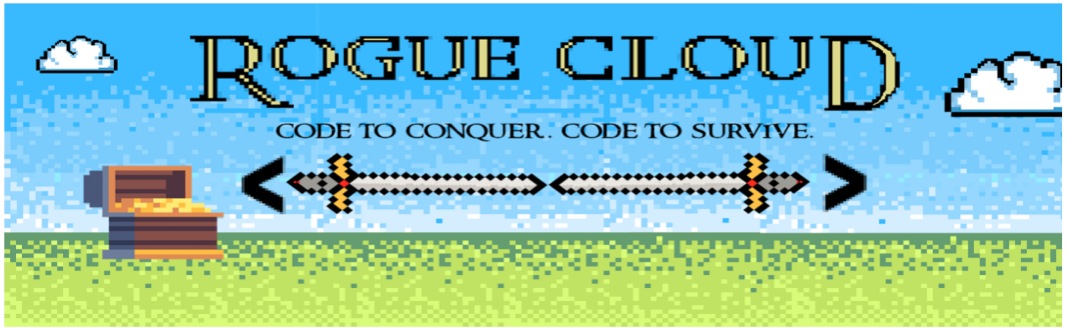
http://ibm.biz/dev2ops

Rogue Cloud Game

- Rogue Cloud overview
- Introduces Microclimate through a game experience
- Documentation

slack [External Slack Channel]





How sharp are your coding skills? Do you consider yourself a master strategist? Are you willing to bet your character's life on it?

Welcome to Rogue Cloud, our homage to the old school roguelike games. We spared you the monochrome graphics, but kept to tradition by creating an open-world, turn based world crawler complete with a top-down 2D multiplayer experience. However unlike a traditional game, where you get the luxury of a controller, keyboard, or mouse, with Rogue Cloud, you are writing code to ensure your character's success...and survival, in a dangerous world.