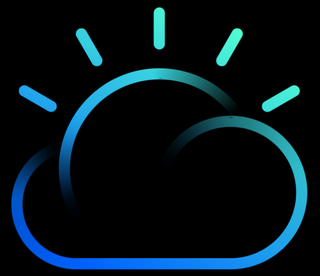


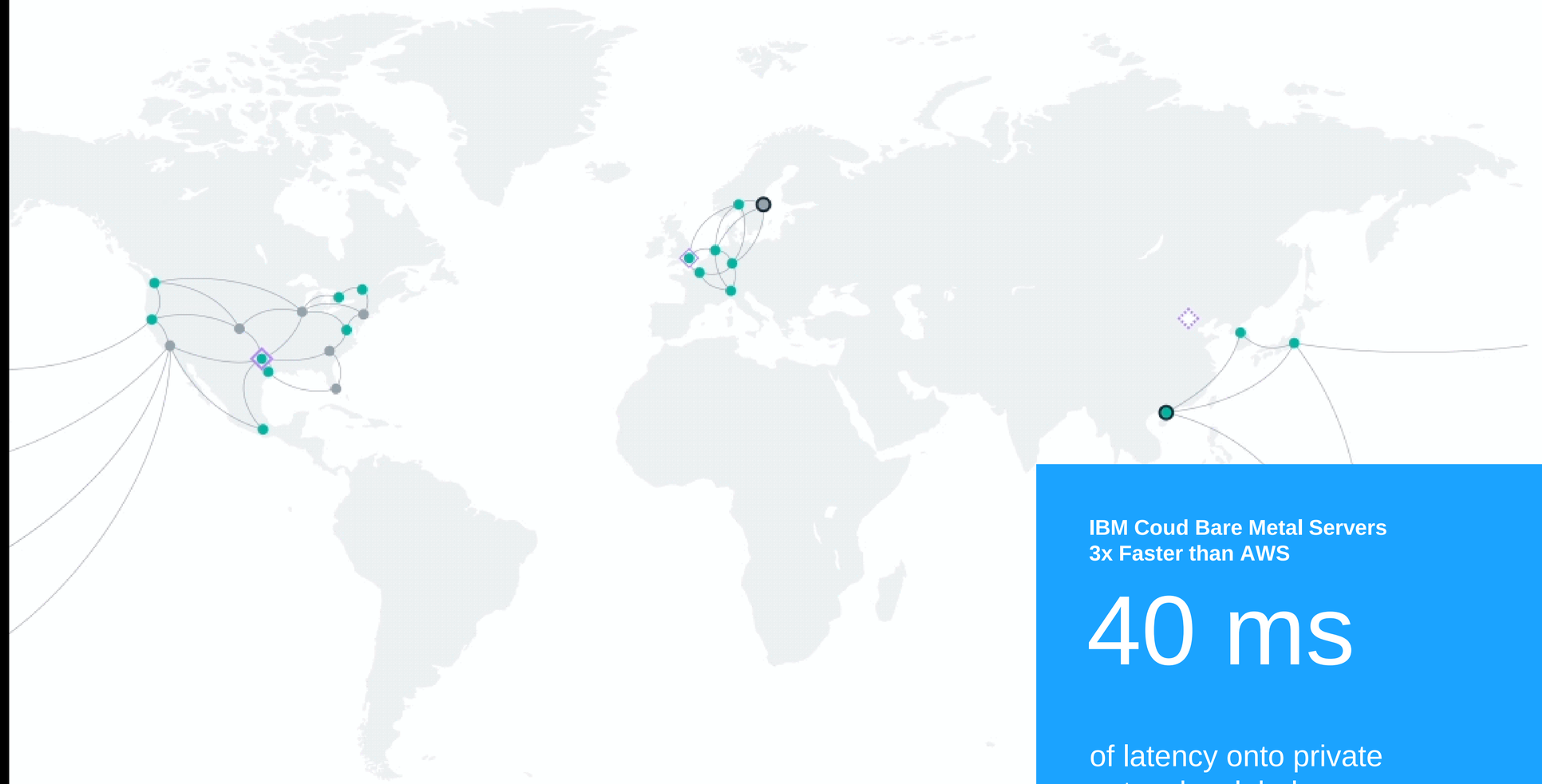
IBM **Cloud**

Optimize your business and deliver signature customer experiences by applying cognitive services to data on any workload — all placed on the right type of cloud.

Data Centers: Globally local

Built with multiple deployment options for your unique workload needs

Choose where to deploy from nearly 60 locations in 19 countries



IBM Coud Bare Metal Servers 3x Faster than AWS

40 ms

of latency onto private networks global

Only IBM delivers an architecture engineered for business optimization and delivering signature customer experiences.

Applications, solutions and services

Targeted solutions for enterprise businesses

- IBM Services & Ind. Solutions
- Weather
- Watson Cyber Security
- Cloud Video
- Watson Explore and Discover
- IBM Risk and Compliance
- Watson Virtual Agent
- …more

AI

Cognitive building blocks for developers

- API Conversation
- API Discovery
- API Compare and Comply
- API DLaaS
- API Tone Analyzer
- API Personal Insight
- API Visual Recognition
- API Speech
- API Document Conversion
- API Nat Language Understanding
- API Nat Language Classifier
- …more

Data

Tools to prepare data for cognitive

Ingestion → Storage → Analytics → Deployment → Governance

Cloud Infrastructure

A highly scalable, security enabled infrastructure

- Cloud Integration
- Cognitive Micro-services
- DevOps Tooling
- Networking
- Compute
- Security
- Cognitive Systems
- Virtual Servers
- Object Storage
- …more
- Public
- Hybrid
- Private

Infrastructure-as-a-Service Highlights

Smart partnerships for a better cloud

VMware, SAP, and Intel power cloud for the custom workloads your business needs

Built for security

High assurance, enterprise-strong cloud security portfolio and expertise to help you adopt IBM Cloud with confidence

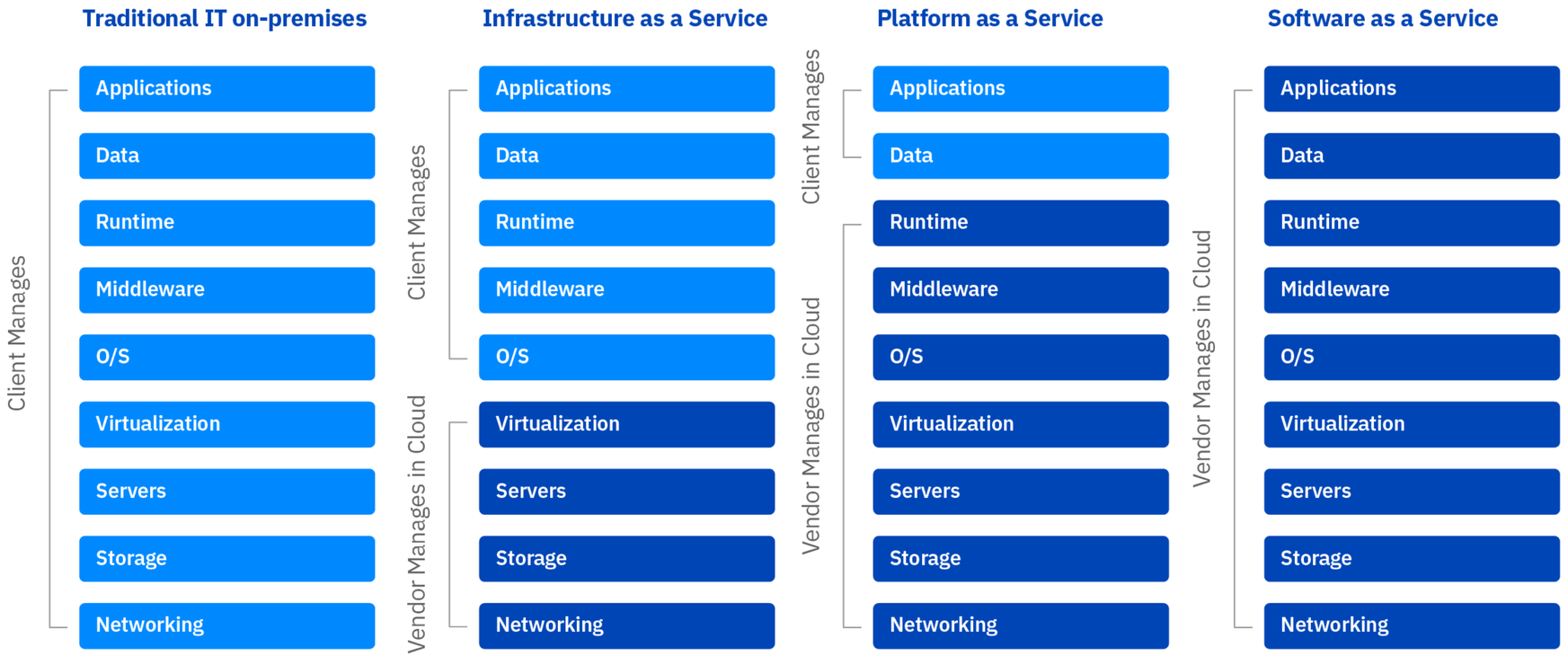
Fast provisioning

Spin up bare metal or virtual servers in 30 minutes or less, with network offerings that provide consistent, cutting edge computing speeds

Power and performance

13 Tbps connectivity on a low latency, high resiliency global network with powerful bare metal and VM compute performance

Infrastructure Stack: Customization vs. Standardization

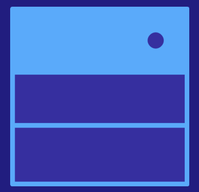


Compute options for any workload, across global infrastructure

← Performance & control — Portability — Development speed →

Bare Metal

Maximum performance and control



Virtual Server or VMware

Leverage existing languages and tools

Containers

Maximum portability

Cloud Foundry

Open PaaS environment

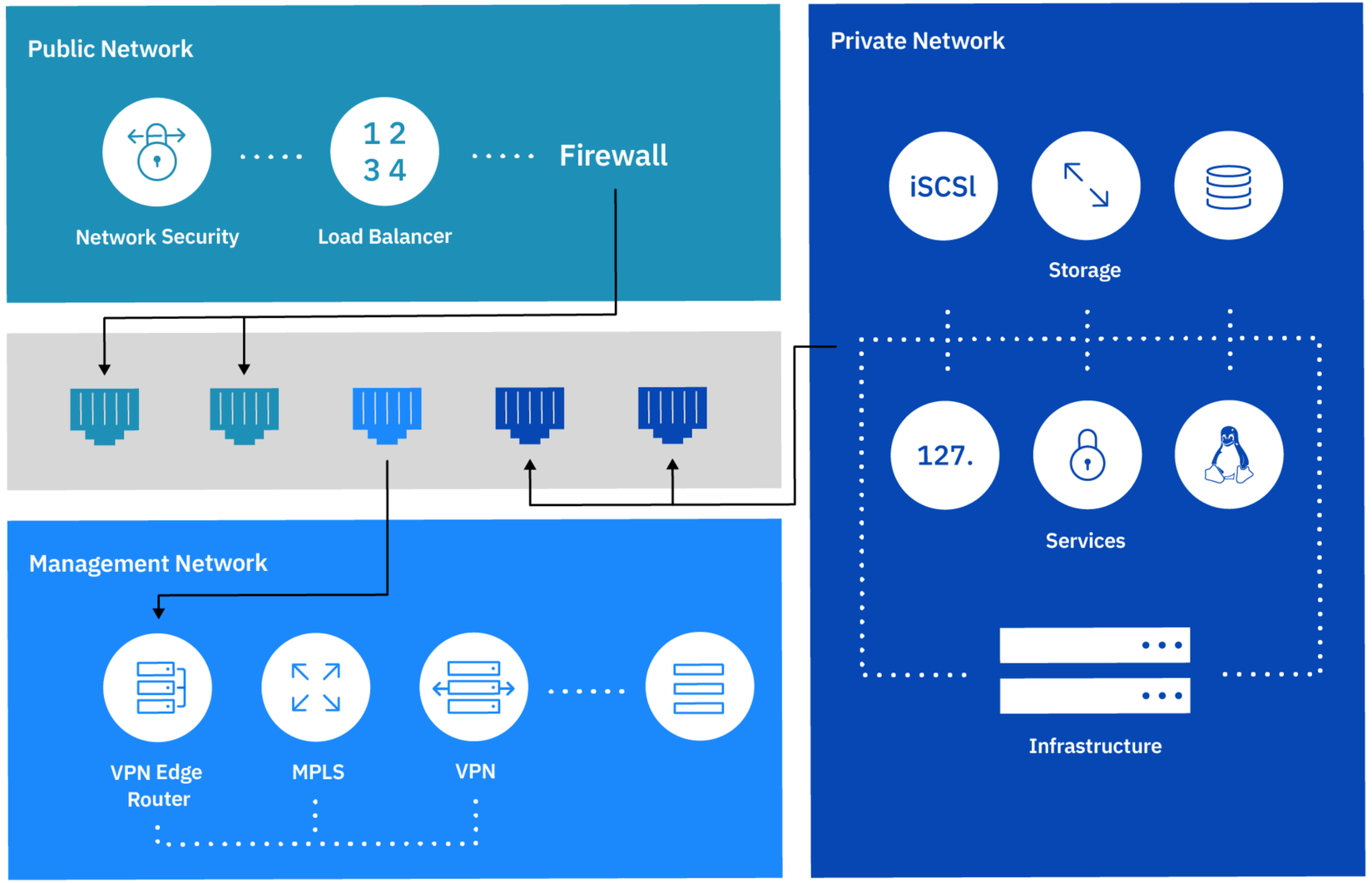
Cloud Functions

Maximum speed with serviceless apps

Unique, triple-layer network architecture

Public, private, and management traffic travel on separate networks, giving you unmatched control, security, and speed.

The private network connects your services in all data centers, free of charge.



Compute Infrastructure

SAP Certified Servers

Build, deliver, and run SAP applications in the cloud

Bare Metal Servers

Raw IaaS horsepower for processor-intensive and disk I/O-intensive workloads

Virtual Servers

Fast deployment when resources are needed on the fly

GPU Computing

Handle complex, compute-intensive workloads, including analytics, graphics, and AI

POWER Servers

Develop, test, and run Linux applications

Server Software

Operating systems to control panels to simplify IaaS administration

Bare Metal Processor Options

Single Socket

Ideal for:

Entry-level web hosting

Development sandbox

Simple email servers

Dual Socket

Ideal for:

Hosting resellers

Moderately-sized websites

SMB back office apps

Quad Socket

Ideal for:

High transaction apps

Virtualization

Disaster recovery

Octo Socket

Ideal for:

Everything quad socket servers offer plus in-memory computing with large database applications. *Only available with SAP offering.*

Bare Metal Chassis Drive Capacity

Run multiple parallel servers simultaneously to work on core business applications

1U
4 Drives

2U
12 Drives

4U
36 Drives

12U
40 Drives

Bare Metal
Hard Drive Options

SSD SED

- High performance, low latency, enterprise-class storage
- Drive capacities up to 3.8TB
- Ideal for high-performance and data-intensive applications

SAS

- Includes 3.0Gb/s interface with 16MB cache and 15K RPM rotation speeds
- High performance speed and reliability
- Ideal for gaming, database, streaming media, and mission-critical servers

SATA

- Each unit includes up to 6.0Gb/s interface with 64MB cache (SATA III)
- Drive capacity ranges 1TB to 10TB
- Each unit includes up to 6.0Gb/s interface with 64MB cache (SATA III)
- Ideal for web, mail, or high-capacity storage servers

3D XPoint™ Technology

- High performance cell and array architecture that can switch states 1000x faster than NAND
- 10x denser than conventional memory
- Storage and memory converged

Virtual Servers

Real challenges and real solutions

Dynamic Workloads

Not all workloads are the same—some require different resources

- Small, medium, large sizes
- Various isolation types
- Data stored where you need

Flexibility

Allows for dynamic resizing depending on data

- Fast provisioning times
- Hourly or monthly models

Predictability

High and predictable performance

- No oversubscription of vCPU or RAM
- Guaranteed 2.0 GHz or faster

Virtual Servers

Virtual servers give you fast access to compute resources to meet any workload

Public

Multi-tenant offering with rapid provisioning and scalability

Dedicated Instance

Single tenant offering with rapid provisioning, allowing further control and flexibility in virtual server deployments

Dedicated Host

Virtual servers dedicated to customers providing the most control by enabling workload placement and flexibility in virtual server deployments

Virtual Server Families and Applications

Balanced

Common cloud workloads requiring a balance of vCPU and RAM

Compute

Front end, batch-processing workloads, requiring more compute than memory

Memory

Caching, in-memory, database solutions, requiring more memory than compute

Balanced Local

Common cloud workloads requiring a balance of vCPU and RAM along with local storage (SSD and HDD options) and performance

GPU Computing

Real challenges and real solutions

AI

Add GPUs to enable up to 65% more machine learning than traditional servers*

Big Data

Take on massive data analytics computations

GFX Applications

Get blazing speeds for graphic-intensive workloads like 3D CADs and data rendering for gaming

GPU Computing

NVIDIA Tesla P100/K80

Applications: AI, deep learning

Get up to 50x performance over the Tesla K80

Enable up to 65 percent more machine learning*

NVIDIA Grid K2

Applications: Professional-grade graphics

- Ramp up any graphics applications that require blazing speed
- *NEW* Now available by the hour

NVIDIA Tesla M60

Applications: Data analysis, scientific computation

Massive data analytics computations

NEW Now available by the hour

POWER8 Servers

Real challenges and real solutions

DB2 and/or WebSphere

Developers use POWER systems to create applications in the cloud and deploy to your private cloud

On-premises to Cloud Integration

Integrate real time unstructured data analysis in IBM Cloud to support new applications

Custom Workloads

POWER8 provides the best core-for-core performance for compute-intensive workloads in genomics, biotech, financial, and retail

Open Source Databases

Prove performance advantages of Postgres MongoDB, Redis, and many other open source database services

Server Software

Software options installed during server deployment or via customer portal on demand, licensed, and billed month-to-month

Operating system	Virtualization	Security	Database	Control Panel
•CentOS •CoreOS •CloudLinux •Debian •FreeBSD •Microsoft •Red Hat •Ubuntu •Vyatta Network	•Citrix XenServer •Virtuozzo •Microsoft Hyper-V •VMware vSphere	•APF Software Firewall •McAfee Total Protection •McAfee Anti-Virus •McAfee Host Intrusion Protection •Microsoft Windows Firewall	•Microsoft SQL Server (2012, 2014, 2016) •MySQL •IBM Cloud Analytics •MongoDB •Basho Riak	•cPanel/WHM with Fantastico, RVSkin, and Softaculous •Plesk

Improve and integrate systems in the cloud

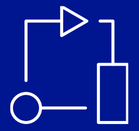
Content Delivery Network (CDN)

Scalable, low-cost security solution

Accommodates a variety of firewalls and security groups

Leverages best-of-breed providers

Load balancing



Flexible deployment and pricing

SSL offloading

Local and global options

Citrix NetScaler version available

Direct Link

Move data across connections of up to 10Gbps

All bandwidth charges are unmetered

Optional global routing provides private network access

Network Security

Akamai CDN capabilities beside IBM Cloud Object Storage

Firewalls, security groups, and DDoS protection

Highly efficient data delivery

Demand and usage flexibility

Direct Link

IBM Cloud Direct Link helps ensure the security of sensitive data to and from the IBM Cloud. Back up or store huge volumes of data from your data center on IBM Cloud with predictable bandwidth costs. With a dedicated network connection, your transfer rates are fast, consistent and reliable.

- **Faster speed, lower latency:**
  Move data to and from your data center across network connections at speeds up to 10Gbps.
- **Higher security:**
  Protect your sensitive, business-critical data by controlling every network hop.
- **More reliability:**
  Receive consistent, higher-throughput connectivity between a remote network and your IBM Cloud environments.

Network Security Options

Shared Hardware Firewall

- Protection for single servers provisioned on demand without service interruptions.

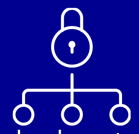
Dedicated Hardware Firewall

- 1Gbps, single-tenant protection for servers that share the same VLAN
- Provisioned on demand without service interruptions

FortiGate® Security Appliance 10Gbps

- Single-tenant firewall for multiple VLANs on public and private networks
- Provides access to add-ons such as intrusion prevention, anti-virus protection, and web filtering

Security Groups



- Value-added network security solution
- Define security policies at the instance level
- No support for bare metal

VMware

Core Platform Offerings

- Managed and Professional Services
- Partner and Ecosystem Solutions
- Additional VMware options

VMware vSphere on IBM Cloud

VMware vCenter Server on IBM Cloud

VMware Cloud Foundation on IBM Cloud

vSAN Storage Virtualization

vCenter Management

VMware NSX Network Virtualization

VMware vSphere Compute Virtualization

Bare Metal (Physical Compute, Network and Storage)

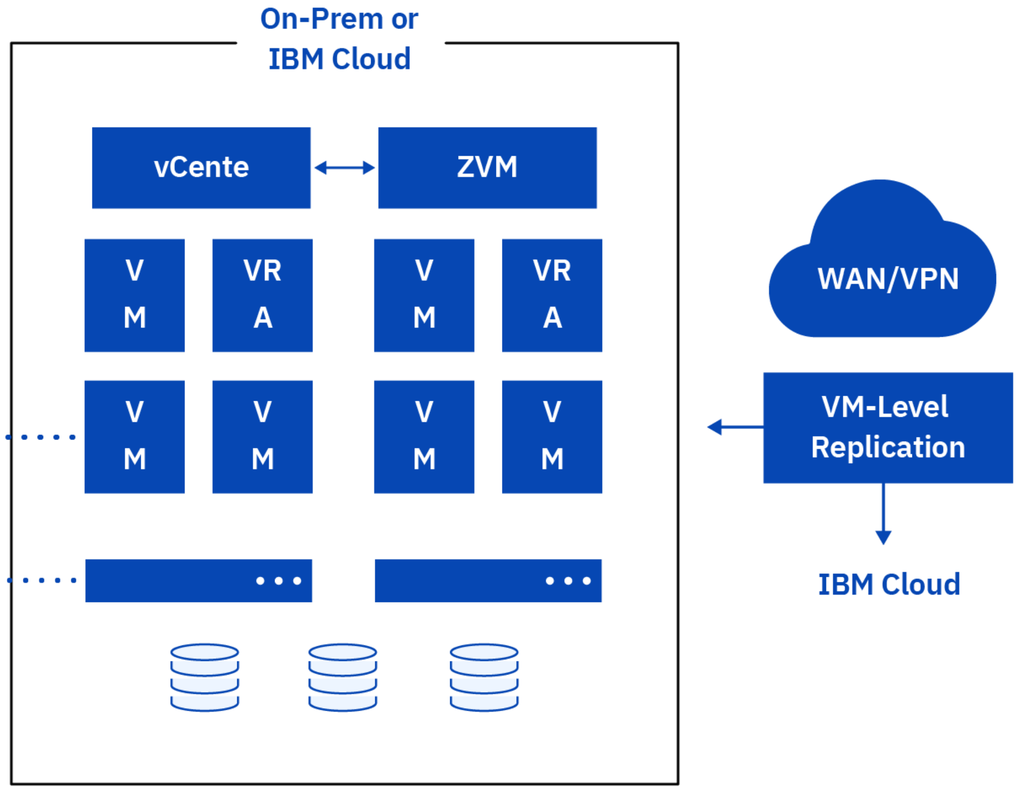
IBM Cloud for VMware Solutions Portfolio

Automated Provisioning **First Cloud Foundation Service in Market** **Monthly subscription - based services with no commitment**	**VMware Cloud Foundation On IBM Cloud**	— Complete VMware Software Defined Data Center: vSphere on Bluemix® Bare Metal, NSX, vSAN & SDDC Manager lifecycle management capabilities
	VMware vCenter Server On IBM Cloud	— Flexible architecture with easy-to-manage logical firewall powered by NSX, vSphere on Bluemix® Bare Metal, & shared file-level storage
	Zerto On IBM Cloud	— Zerto Disaster Recovery solution on IBM Cloud Secure and Flexible way to Protect environments in IBM Cloud
	Veeam On IBM Cloud	— Veeam Availability Suite on IBM Cloud back-up and replication for on-premises and cloud workloads
	IBM Cloud Secure Virtualization	— Intel TXT technology & HyTrust software — Geo-fencing of data for GDPR requirements — Reduce audit risk with compliance monitoring
Build your own	**VMware vSphere On IBM Cloud**	— vSphere on Bare Metal — Rent Per-CPU license or bring your own VMware licenses

Zerto HYTRUST intel VEEAM

Zerto – Disaster Recovery

Zerto Virtual Manager
•No downtime, install in minutes
•Management interface



•VM block-level changes
•Always-on Replication, Data loss = Seconds
•No snapshots, impact, storage or scheduling

Zerto Benefits

- Enterprise – Class Disaster Recovery
- Hypervisor – based Virtual Aware Storage Agnostic
- Supports VMware and Hyper-V

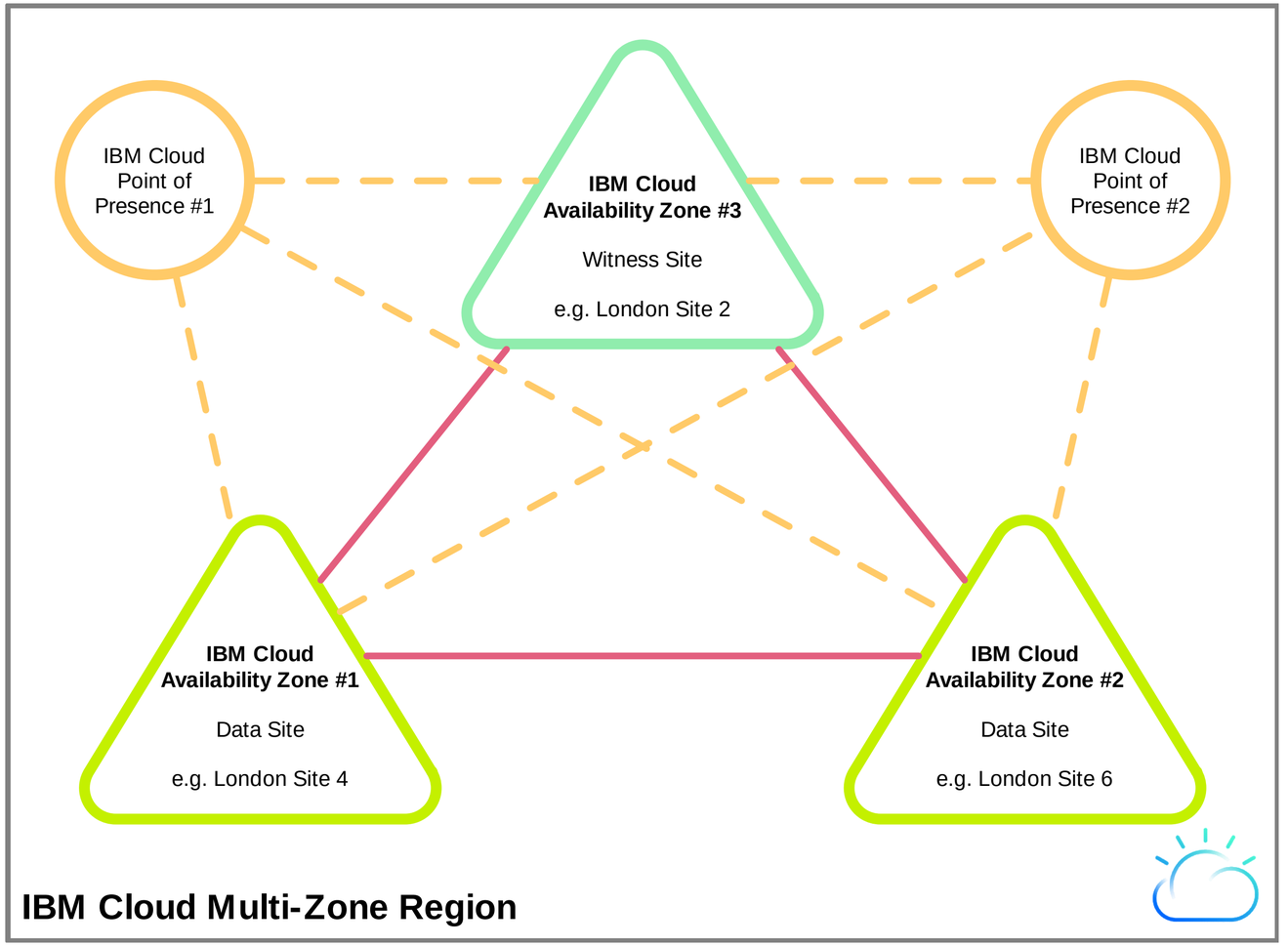
Zerto Offering Details

- Single click deployment from IBM Cloud for VMware portal
- Offered as an add on to a new or existing, Cloud Foundation vCenter Server or vSphere offering

Introducing the…

Mission Critical VMware on IBM Cloud Reference Architecture

Providing a Multi-Site Active/Active Infrastructure with Automated Customer Workload Failover



‘Current’ IBM Cloud Multi-Zone Regions

Americas:

Washington and Dallas

Europe:

London and Frankfurt

Asia Pacific:

Tokyo and Sydney

Storage

Block Storage

Real challenges and real solutions

Large relational databases and file systems

Handle database capacity and performance
by scaling up and create your own file systems

- Oracle
- MS SQL
- PostgreSQL
- MySQL
- Share across multiple servers and apps

NoSQL Databases

Ideal for NoSQL databases

- Provision with specific IOPS
- Achieve specific read and write speeds

High transaction and I/O

Tackle intense workloads
and applications

- Stripe performance volumes together to achieve up to 6k IOPS
- Consistent input/output performance in volumes

File Storage

Real challenges and real solutions

Simple sharing and archiving

File storage simplicity makes sense

- Store and share files in the office
- Cost-effective archiving in smaller environments
- Standard protocol support, native replication

Hypervisor VM Storage and VDI

Meet the needs of virtual environments

- Host a library of VM images
- Private cloud VMs
- Peak IOPS provisioning for file shares

Big data analytics and digital media

Storage solutions for your creators and consumers

- Achieve read/write speeds
- Specific IOPS and capacity
- Always on content across the globe

Block and File Storage

20GB to 12TB storage | Max of 48,000 IOPS(2) | Monthly and hourly billing

Choose your deployment:

1) Endurance tiers:

Specify capacity only (IOPS and throughput scale with volume size). Pre-defined for simplicity. Ideal for most workloads.

Example:

500GB volume @ 2 IOPS
500GB * 2 IOPS/GB tier = 1,000 IOPS total
1000 IOPS * 16kb block size = 16MB/s throughput
$0.20/GB * 500GB = $100/month

2) Performance options:

Specify both capacity and IOPS. Ideal for workloads with well-defined performance requirements.

Example:

500GB volume with 250 IOPS
250 * 16kb block size = 4 MB/s throughput
$0.10/GB * 500 GB + $0.07/IOP * 250 =
$50 + $17.50 = $67.50 / month

Block and File Storage
Industry essentials come standard

At rest data encryption: Disk level with provider managed keys(5)

Expandable volumes/adjustable IOPS: Accommodate dynamic workload needs on the fly

Flash-backed: Decreased latency/increased throughput(1)

Max durability: Maintain availability and integrity through events without RAID arrays

Granular volume sizes: Lower your costs with TB increments

Customizable IOPS: Tailor assigned levels of IOPS tiers and customizable IOPS for top performance

Hourly or monthly: Create short-term use storage volumes for Dev/Ops, DR testing, etc.(3)

Snapshots and replication: Non-disruptive and automatically copied to an IBM Cloud data center(6)

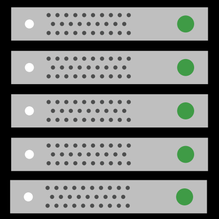
High availability: Uses redundant networking connections to maximize availability; iSCSI-based Block Storage uses Multipath I/O (MPIO)

Volume duplication: Make updates offline, use for DR/Ops or as the golden template

IBM Cloud Object Storage

Cloud Object Storage

Industry leading flexibility, scalability, and simplicity.



On-Premise

- Single tenant
- Design specific to client needs
- Total control of system

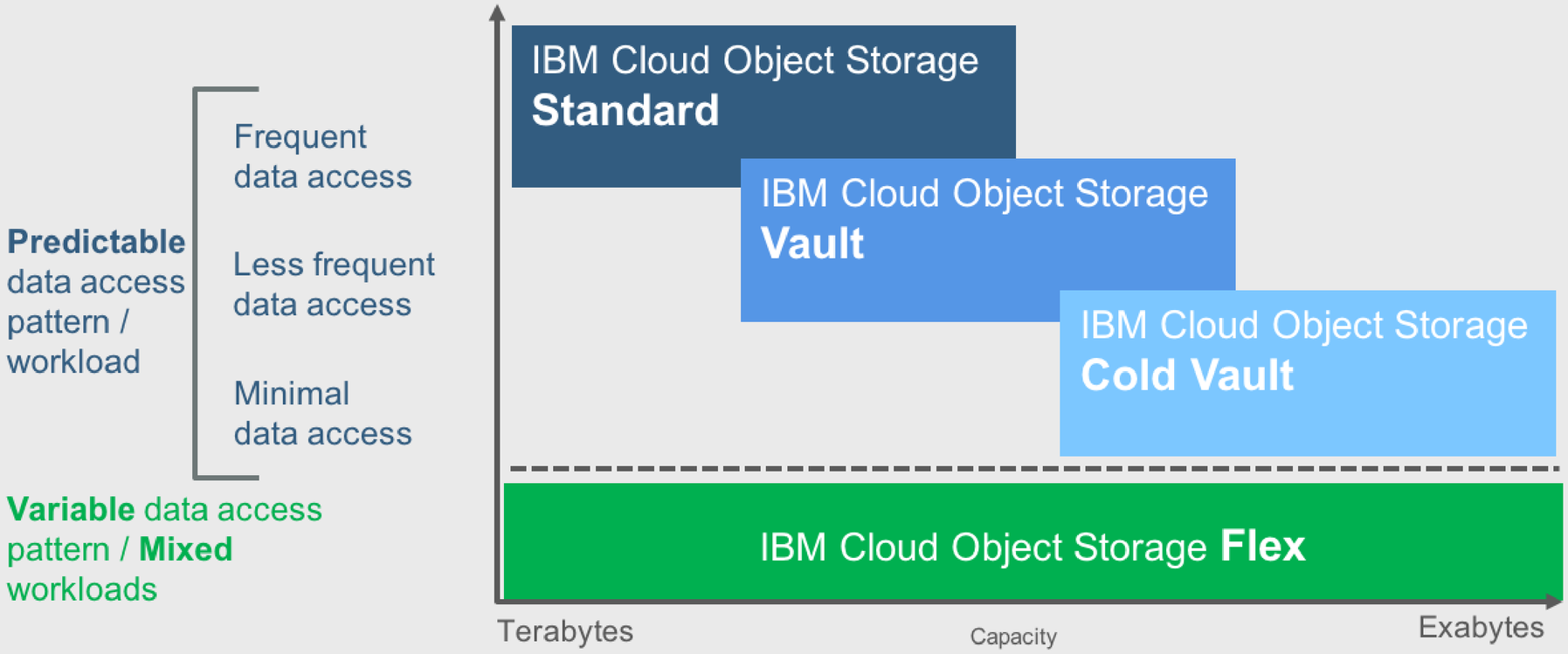
Dedicated

- Single tenant (compliant)
- No datacenter space required
- Flexible configuration options
- OPEX vs CAPEX

Public

- Multi-tenant
- Usage-based pricing
- Elastic capacity
- No data center space required.
- Fully managed
- OPEX vs CAPEX

IBM Cloud Object Storage public cloud services designed for today's dynamic workloads



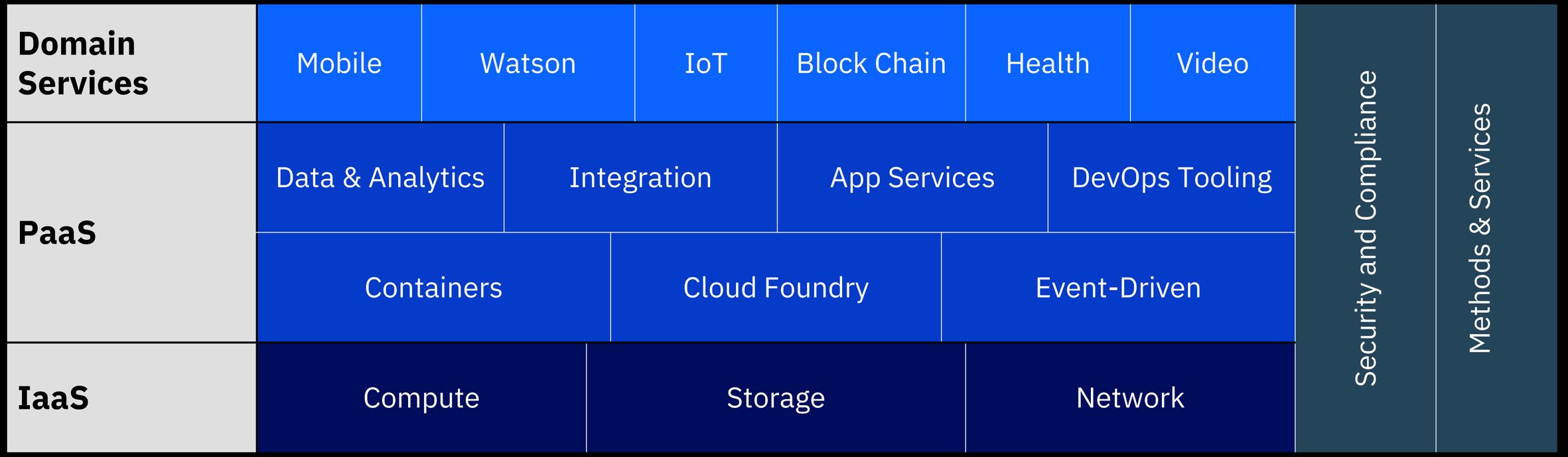
IBM Cloud Object Storage

Public cloud services resiliency options to meet your business needs

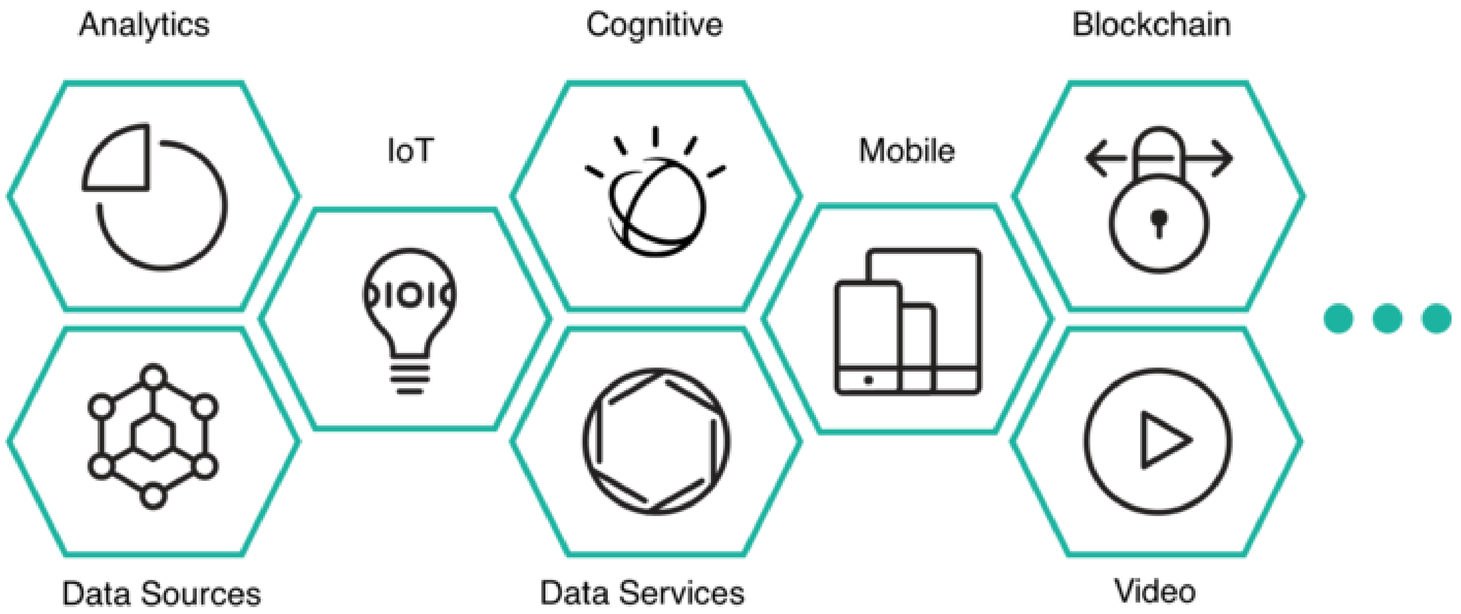
Cross Region (high availability)	**Regional** (low latency)
–Storage in multiple data center facilities across regions. –Data accessible via regional end points for business continuity and availability. –One price, no separate charge for multiple data centers, or bandwidth used across data centers.	–Storage in multiple data center facilities within a single region. –Data accessible via end points in a single region for business continuity and availability. –One price, no separate charge for multiple data centers, or for bandwidth used across data centers.

IBM Cloud for Cloud Native

Cloud Native Platform

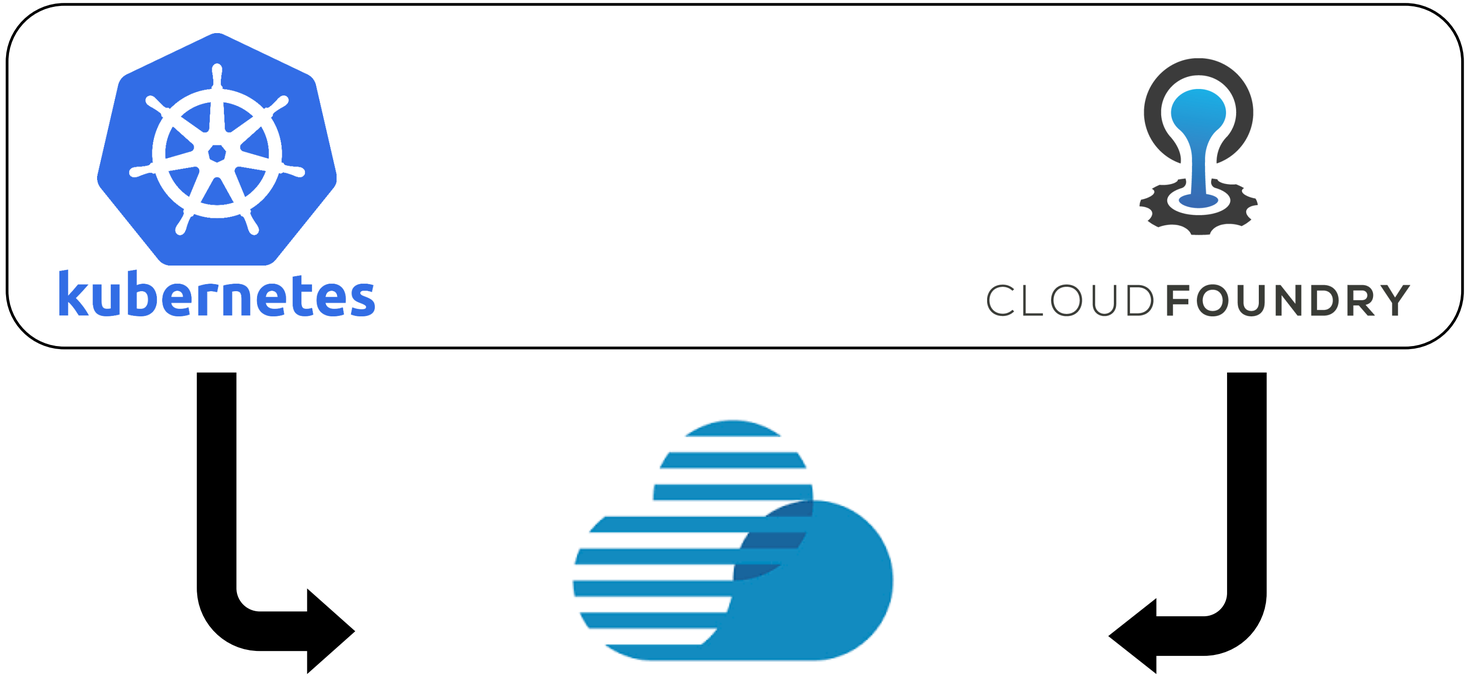


Choose your IBM high-value service

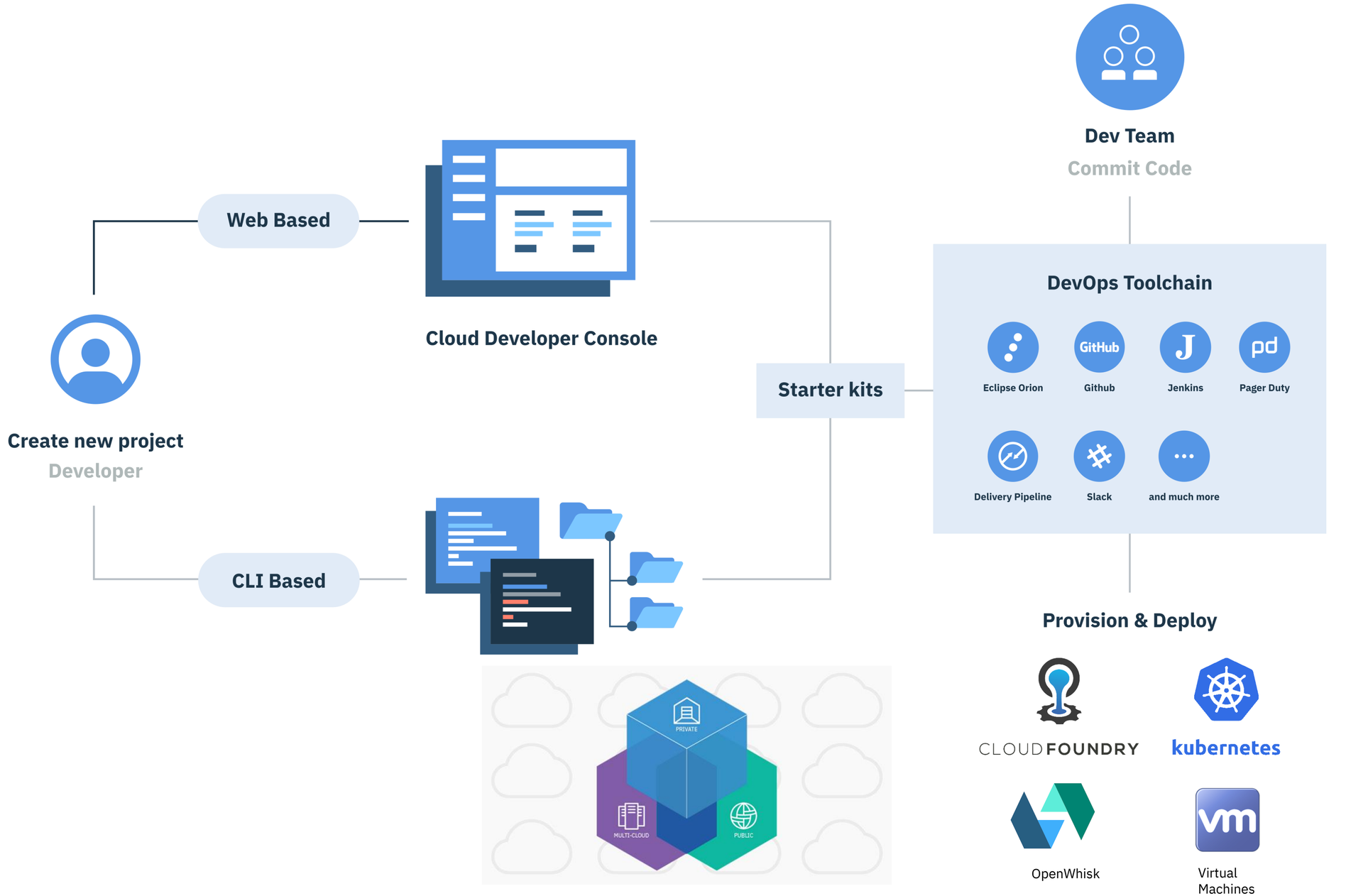


Leverage domain expertise

Choose your deployment platform

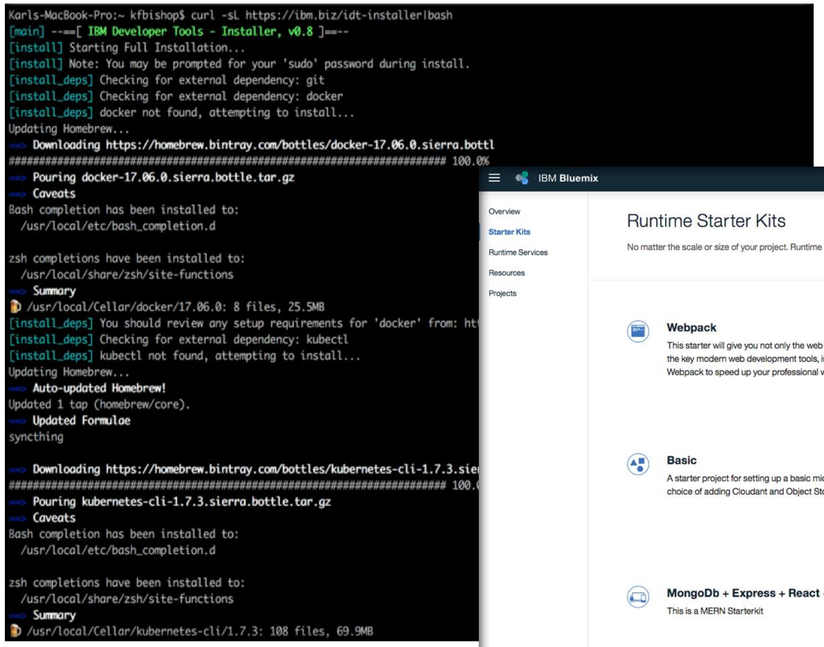


Building a cloud native app

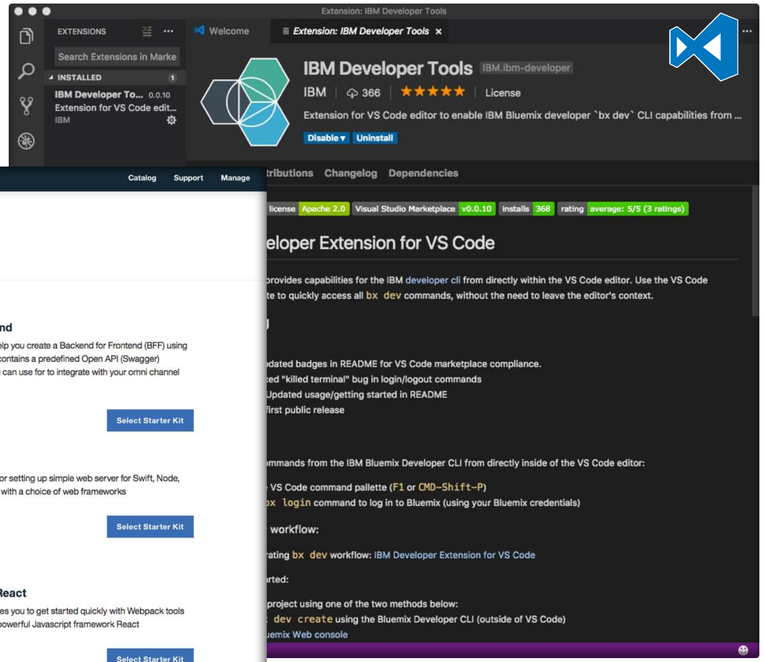


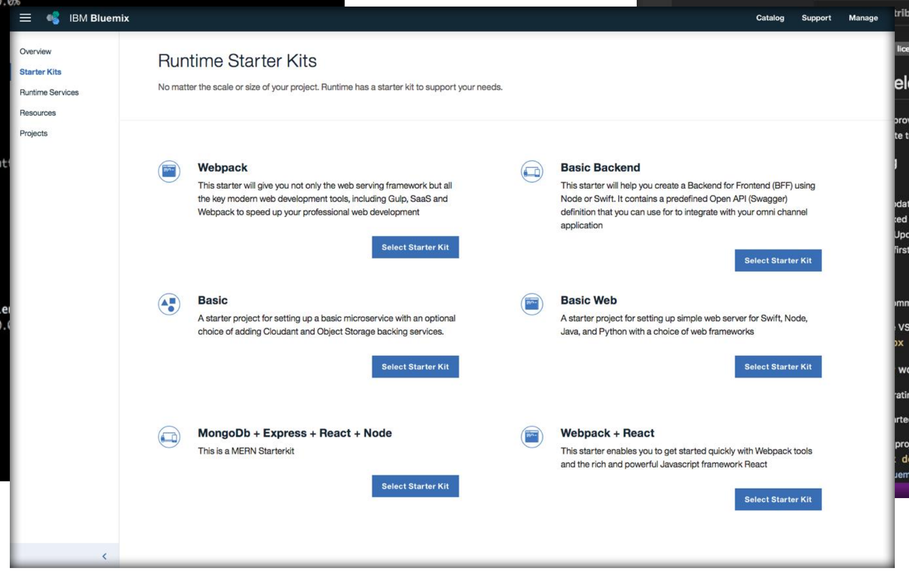
Choose your development experience

Command Line



Integrated Developer Experience





Web Console