



# Impact of Data management on Architecture Design

Oil Industry in Azure

Raouf Aimeur – Cloud Architect

# How AI is building better gas stations transforming Shell's global energy business



Imagine a man lighting a cigarette while he's waiting at the pump for his car to finish fueling at a Shell gas station. He's unaware that with one move he could cause a fire or explosion.

An onsite video camera captures the scene, and a device inside the station running [Microsoft Azure IoT Edge](#) is monitoring the

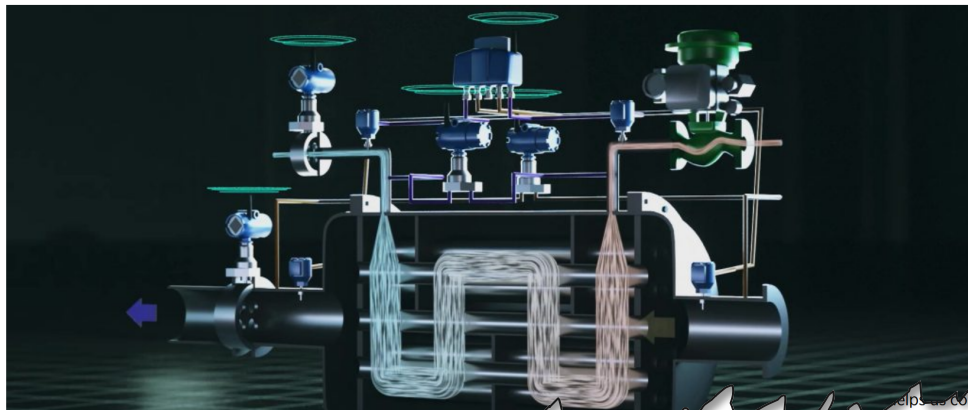
## Chevron's connected machines are telling a story about saving time and money

Deep within a Chevron fuel refinery, one key machine is now talking – and revealing secrets about its own health.

That chatty piece of equipment, called a heat exchanger, removes the heat from fluids flowing through it as part of the plant's fuel processing.

In a pilot program, [Chevron](#) affixed some exchangers with wireless, [Industrial Internet of Things \(IIoT\)](#) sensors that collect and send real-time data from the heat exchanger to the cloud – supplementing information already gathered by the safety and control system.

Data scientists then analyze that fresh data to check the equipment's health status now, and to predict its condition in the future.



A heat exchanger connected to cloud sensors for monitoring of Chevron's refinery.

helps us compete," said Joe Geagea, Chevron's executive vice president. "We already have a head start in digitizing our oilfields, but we want to increase our revenues, lower our costs, and

# BP is using Microsoft Azure to reduce time oil drilling and boost productivity



By [Elly Yates-Roberts](#) on 19 December 2018



## Repsol signs agreement with Microsoft to develop digitisation strategy



By [Elizabeth Robinson](#) on 20 December 2017



Microsoft News Centre Europe

### Topics

[News](#), [Professional services](#), [Office](#), [Cloud](#), [IoT](#), [AI](#)

Global energy firm Repsol has signed an agreement with Microsoft that will help advance its digitisation strategy through the adoption of cloud technologies.

time needed to select its data scientists. to Microsoft's Bill 'drilling down into its

# Logo Oil & Gas

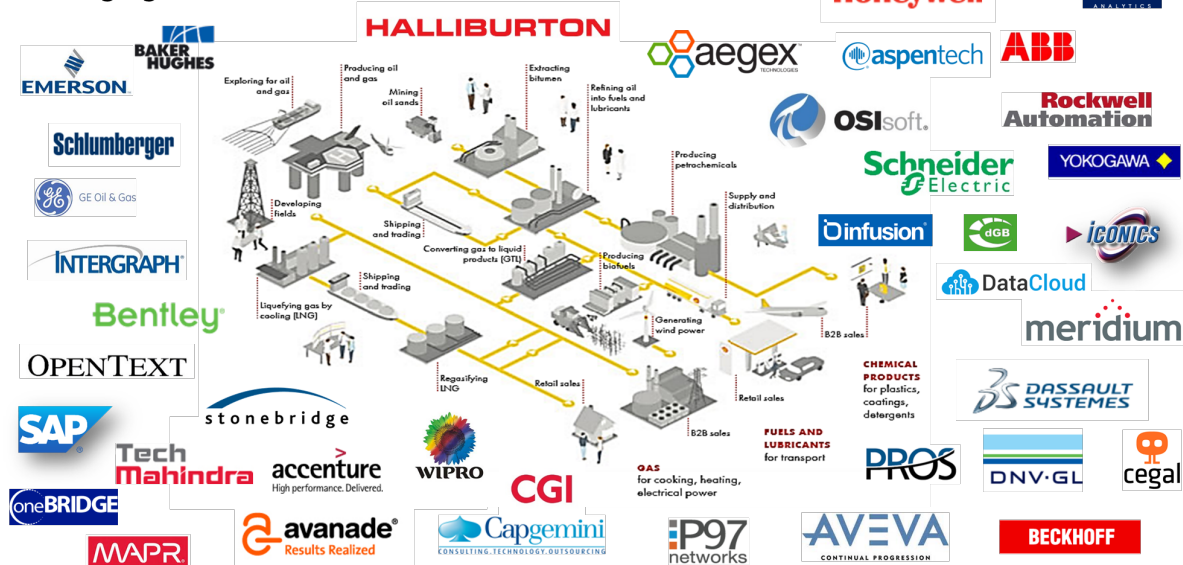


# Azure Big Compute ecosystem



Microsoft Confidential Subject to NDA (Non Disclosure Agreement)

# Oil & gas Ecosystem Leveraging our Global Partners

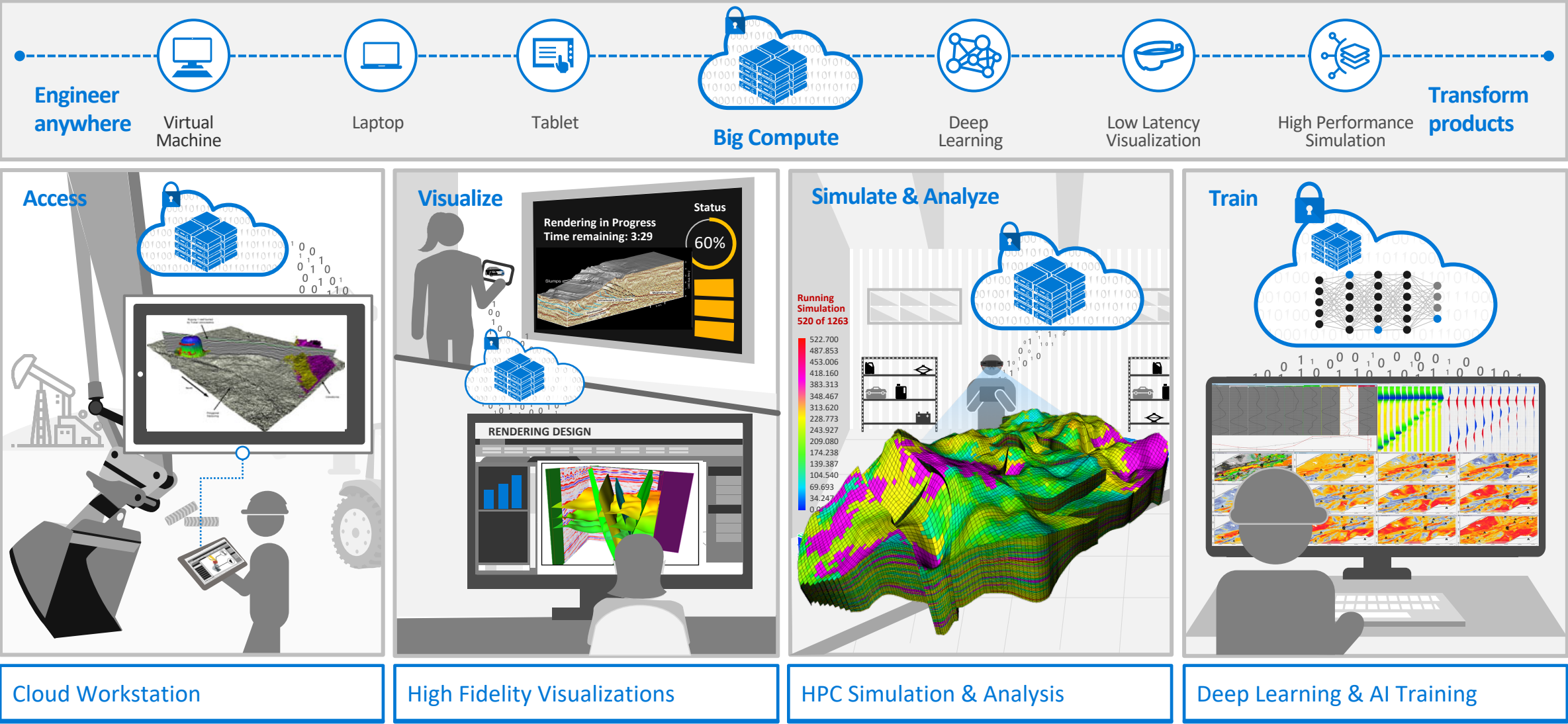


# Industry Solution Map – Process Manufacturing & Resources

Research, Discovery & Development	Product Upscaling & Chemical Engineering	Manufacturing, Sourcing, Packaging and Distribution	Sales & Marketing	Governance, Risk & Compliance
Clinical Data Management (CDM)	Optimized Product Development	Digital Supply Chain	Connected consumer/device	Manage patents, copyrights, and regulatory requirements
Genomics/Bioinformatics Platform	Simulation	Processes Simulation	Sales Force Automation	Document & Records Management
Knowledge Management	Material Safety Data Sheets Authoring and Execution	Personalized Medicine	Closed-loop Mkt	Risk Analytics & Reporting
Project & Portfolio Management	Energy Management	Forecast/Demand Planning	Multi-Channel Marketing/MCM	Regulatory Compliance & Controls
Asset & Equipment Management & Scheduling	Asset and Equipment Management	Product Recall Management	Multi-channel customer experience	Material Safety Data Sheets Authoring and Execution
Innovation Management	Personalized Medicine	Quality Management	Customer/Product/Analysis	Environment, Health & Safety
Hypothesis testing	Geo Data Cloud	Remote Monitoring	Portfolio Management	Manage remediation efforts
Connected Field Service	Smart Reservoirs	Supplier Management	Field Service Efficiency	Manage business resiliency
Manage Research Programs	Asset Modelling	Procurement	Personalization	Control IT infrastructure
Manage Patents, Copyrights, and Regulatory Requirements	Remote Monitoring	Sales, Inventory & Operations Planning	Energy Trading and Risk Management	Vendor Qualification
Asset Modelling	Discovery, trial, approval, & launch	Maintenance & Calibration	Sales and Operations Planning	Plan and manage regulatory approval
Discovery, trial, approval, & launch	Remote Monitoring	Logistics Management	Strategic planning/FC	Prevent counterfeiting
Remote Monitoring	Biobanks, Scientific Networking	Precision farming	Pricing Strategy	Track & Trace
Subsurface data platform	Subsurface Data platform	Immersive Training	CRM	Manage patient safety
Sample to answer platform	Sample to answer platform	Asset Management	Social Listening	
xRM for Oil and Gas	Corporate Sustainability	Energy Management/Smart plants	Sales and Operations Planning	
Corporate Sustainability		Capital Project Management	Energy Trading and Risk Management	
			Fuel Retail Management	
			Loyalty Management	
			Engage your Customers & Citizens	
			Empower your Employees	
			Optimize your Operations	
			Transform your Products	



# Accelerate innovation with Big Compute from Microsoft





## Platform Services

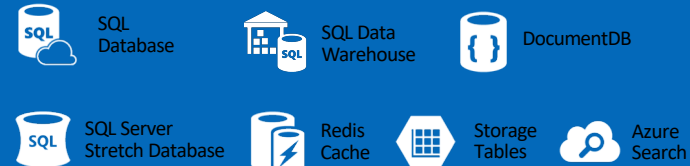
### Media & CDN



### Application Platform



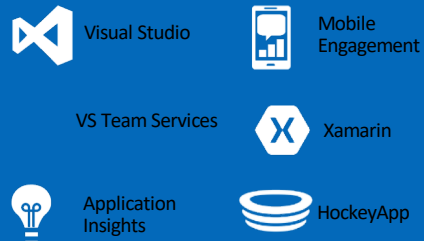
### Data



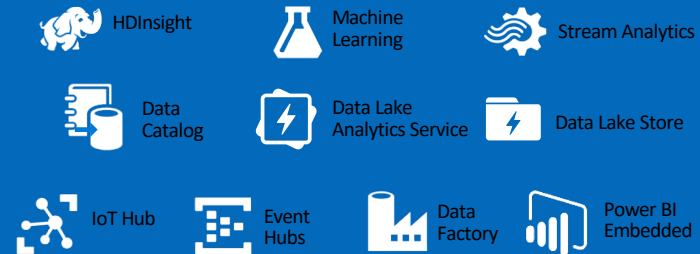
### Intelligence



### Developer Services

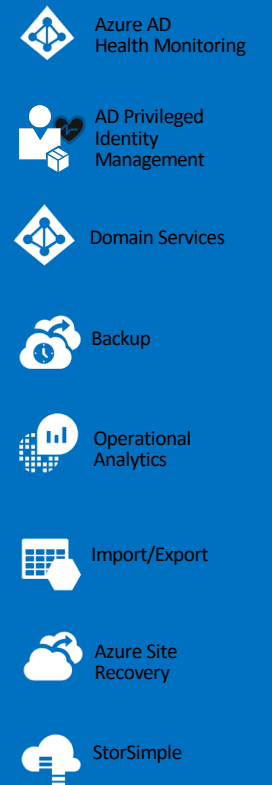


### Analytics & IoT

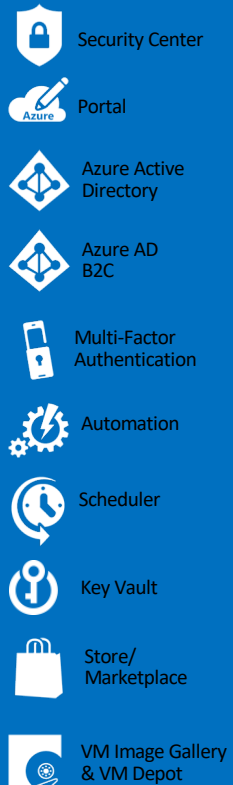


## Infrastructure Services

### Hybrid Cloud



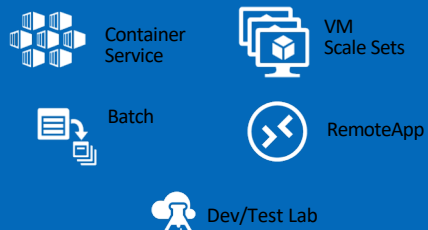
### Security & Management



### Integration



### Compute Services



### Compute



### Storage



### Networking



## Datacenter Infrastructure

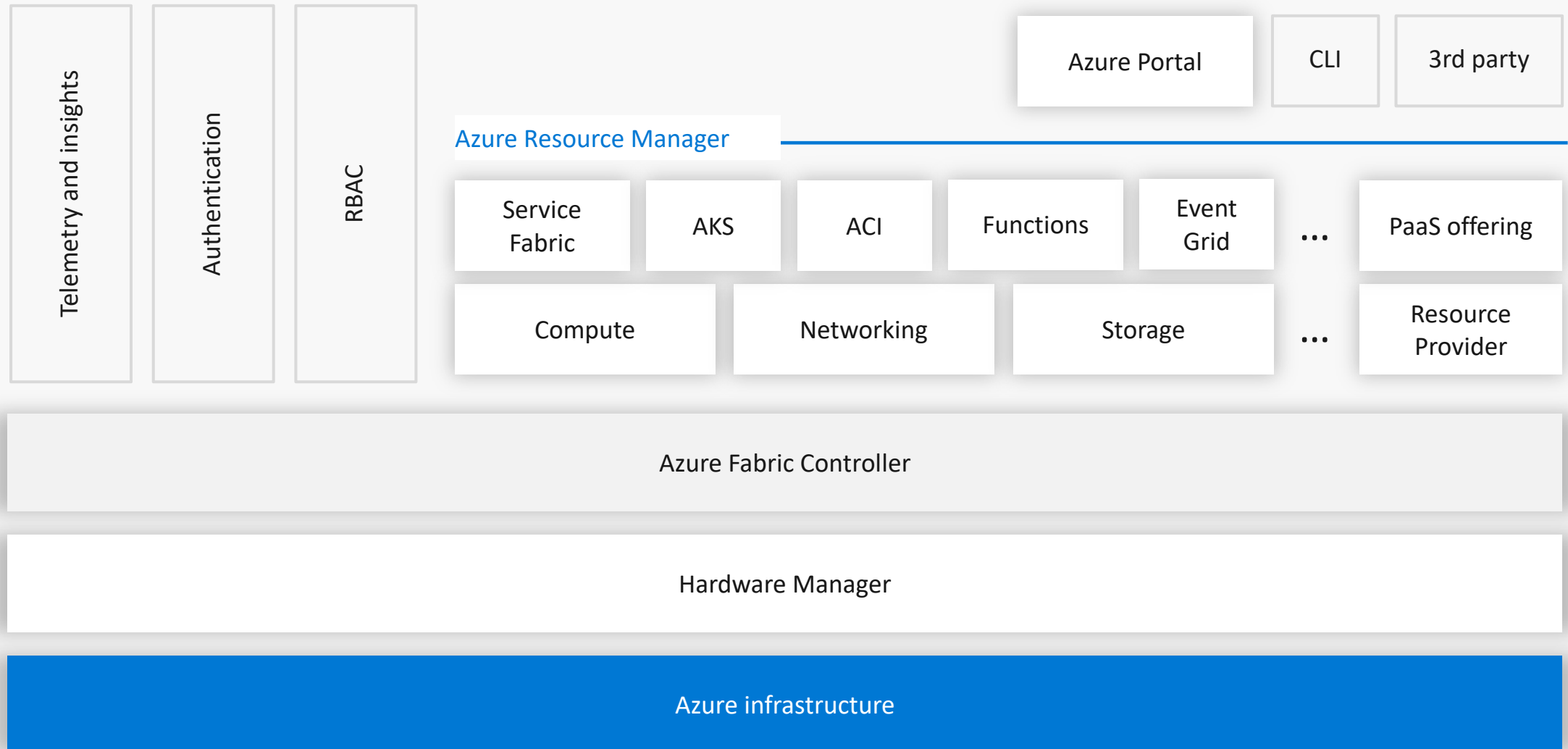


# Evolving services to Hyper-scale

Delivering hyper-scale services requires a radical restructuring of technology, processes, and people

	Enterprise IT		Hyper-Scale		Enterprise IT		Hyper-Scale
Seats	10,000	→	1,000,000,000	Hardware	Custom	→	Commodity
Talent	Custodians	→	Designers	Deployment	Manual	→	Automated
Data Quality	Directional	→	Foundational	Availability	Infrastructure	→	Service
Data Access	Pull	→	Push	Operability	MTBF	→	MTTR
Assessment	Physical	→	Statistical	Reliability	Hardware	→	Software
Supply Chain	Process	→	Strategic	Security	Audit	→	Intrinsic
Budget	Fixed Cost	→	Rates	Network downtime	Impacting	→	Irrelevant
Architecture	Siloed	→	Integrated	Network availability	99.999%	→	99.9%
Application integration	Loose	→	Tight	Design	Primary/Backup	→	Active/Active
Infrastructure	Overhead	→	Enabler	Deployment time	Weeks	→	Minutes
Reach	Regional	→	Global	System admin	UI	→	API

# Azure architecture

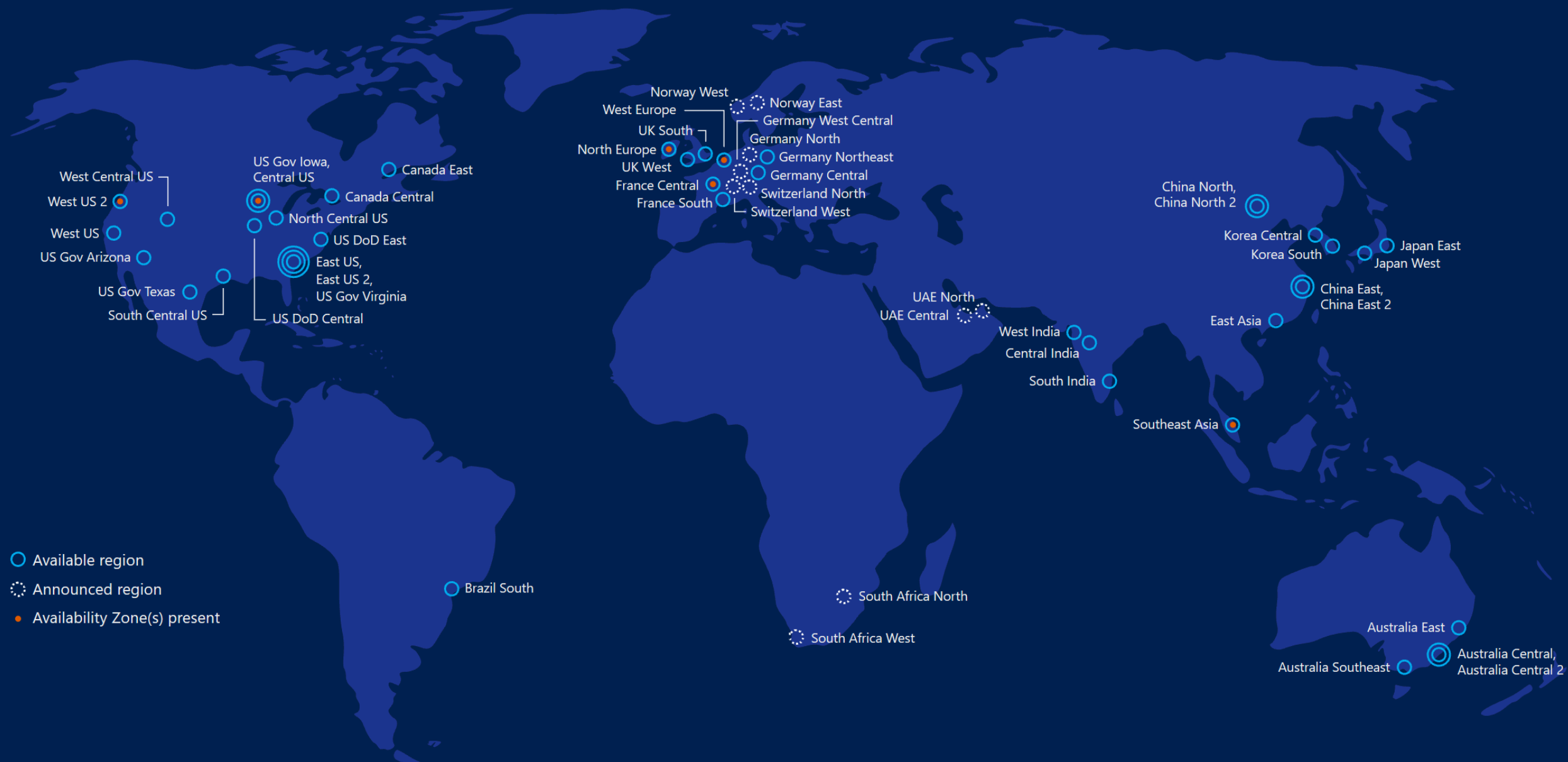




**54** regions worldwide

**140** available in 140 countries

<https://azure.microsoft.com/en-us/regions/>



2M Miles / 3.2M Km  
intra-datacenter fiber

72+  
Tb per second  
backbone





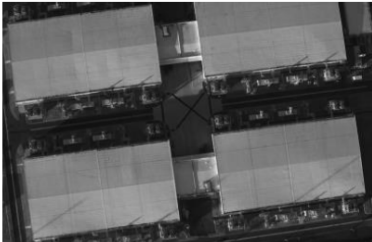

150+  
datacenters

Millions  
of servers



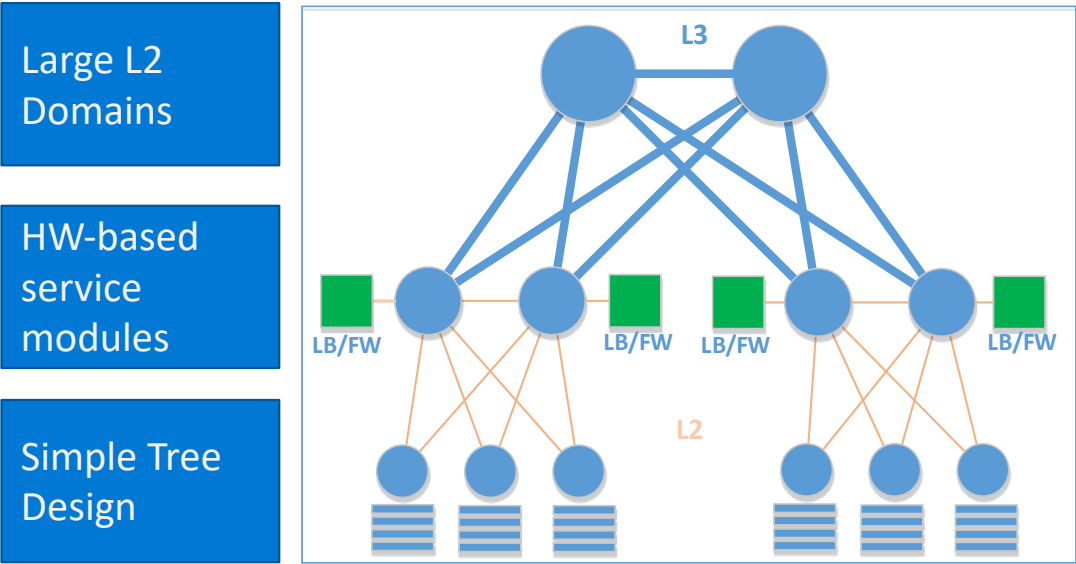
DCs and network sites not exhaustive

# Datacenter evolution: from 1989 to today

2.0+ Power Usage Effectiveness (PUE)	1.4 – 1.6 PUE	1.2 – 1.5 PUE	1.12 – 1.20 PUE	1.07 – 1.19 PUE	TBA
					
1989-2005 Colocation	2007 Density	2009 Containment	2012 Modular	2015 Hyper-scale	2016+ Watch this space!
Discrete servers Capacity 20 year technology	Rack Density & deployment Minimized resource impact	Containers, PODs Scalability & sustainability Air & water Economization Differentiated SLAs	Deployment Areas & ITPACs No more traditional IT Right-sized Faster time-to-market Outside air cooled	Fully integrated Resilient software Common infrastructure Operational simplicity Flexible & scalable	Direct current power Alternative energy Underwater facilities Software automation Security innovation
Generation 1	Generation 2	Generation 3	Generation 4	Generation 5	Next Gen



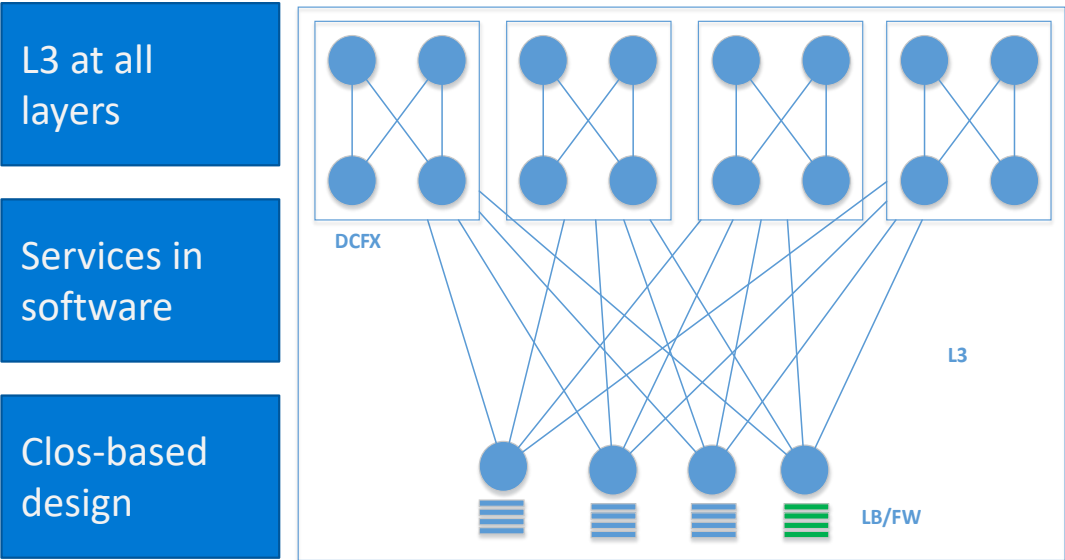
# Classic network vs. Hyper-scale architecture



Low due to diversity and manual provisioning process

Low due to complex hardware and lack of automated operations

Low due to high complexity and human error



Agility

Efficiency

Availability



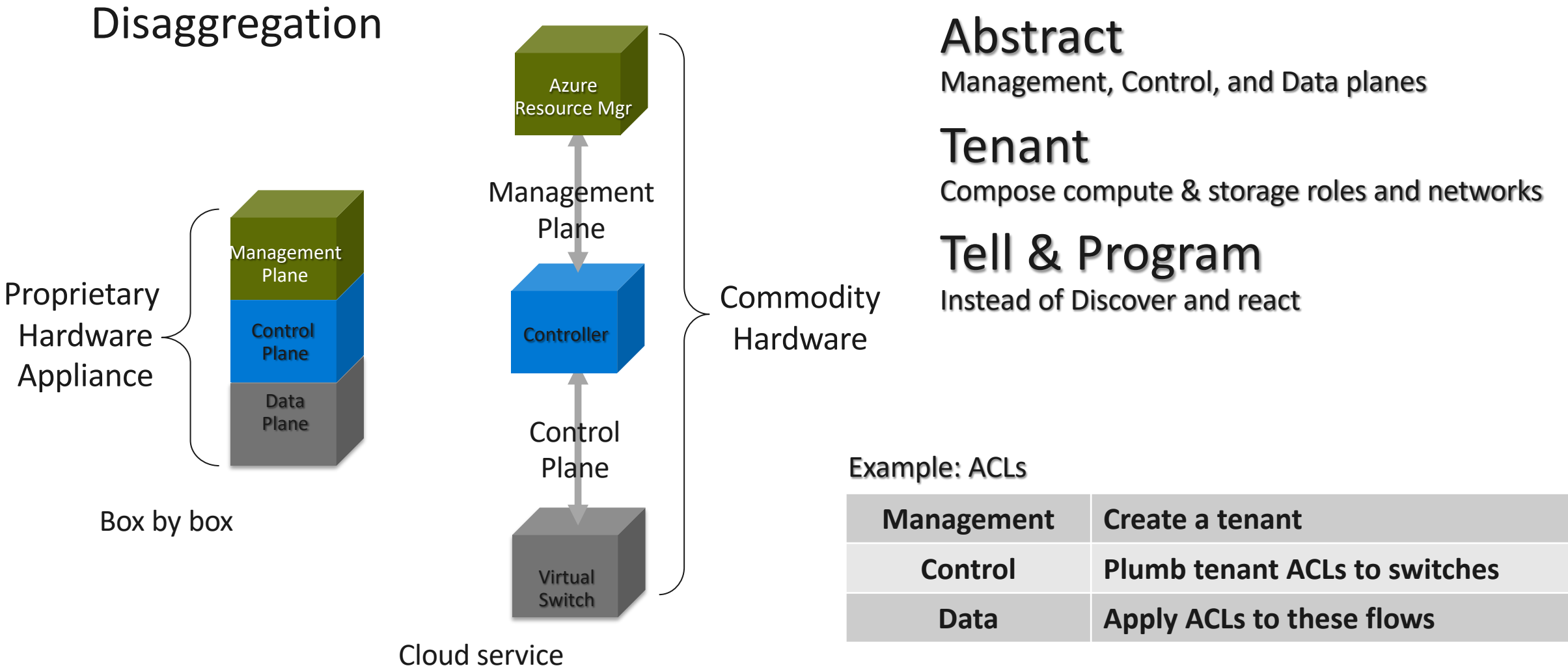
Automated network provisioning, integrated process

Simplify requirements, optimize design, and unify infrastructure

Resilient design, automated monitoring and remediation, minimum human involvement

# Virtual Networks delivered via SDN

Building the right abstractions to enable Scale and Agility



# Microsoft Open Cloud Server – Jan 2014



## > One Million Servers

- \$15 billion infrastructure investment over 20 years
- Global infrastructure enables 200+ cloud services
- Close collaboration with hardware partners



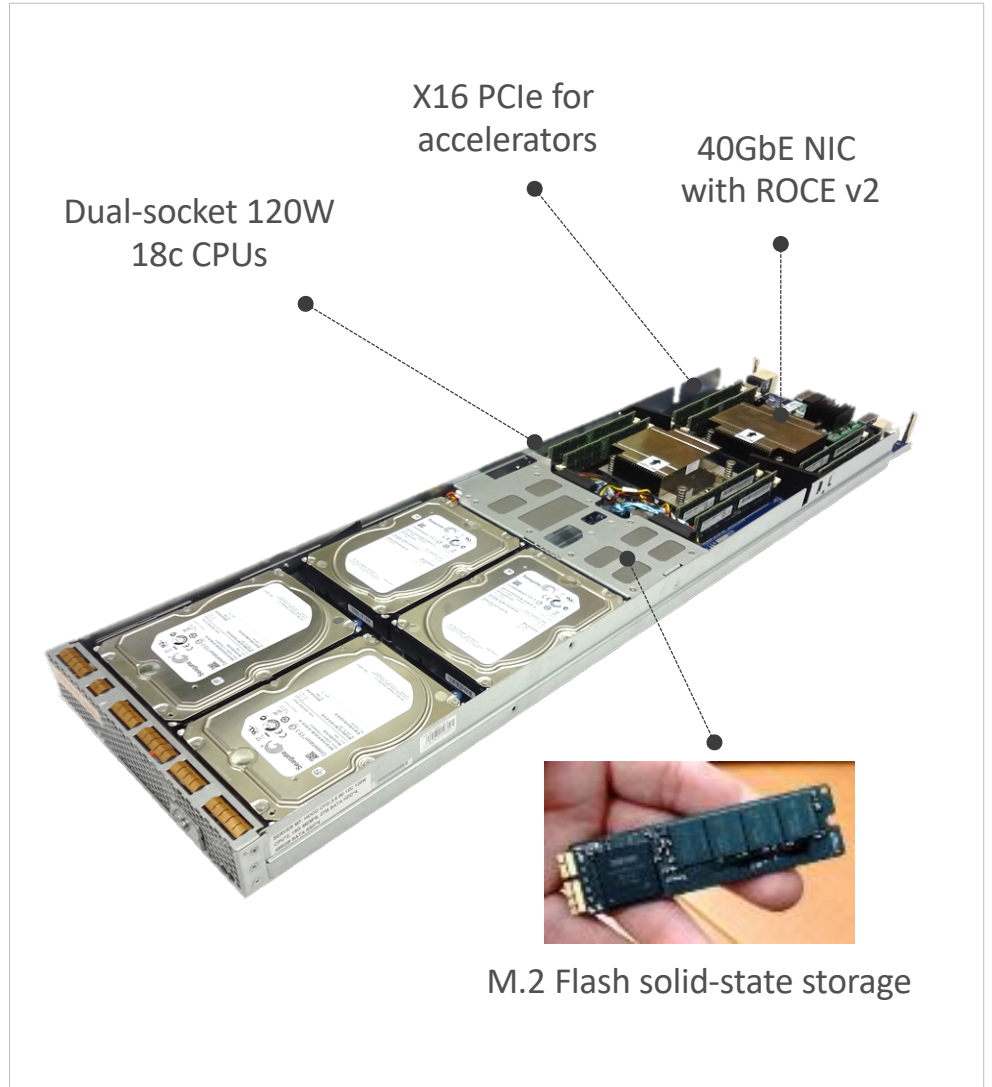
## Open Compute Project

- Contributed Microsoft Cloud Server Specification
- Hardware Supports Azure, M365 and Bing
- Innovation in modularity, simplicity and efficiency



## Driving Customer Benefit

- Deliver hyper-scale learnings
- Drive innovation in the hardware ecosystem
- Microsoft innovations in the hands of customers





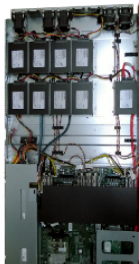
# Azure servers: General purpose



0.00000000533  
Beast



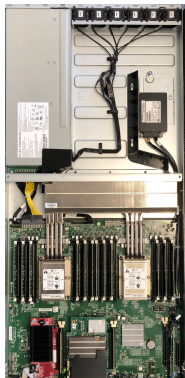
Gen 2	
Processor	2 x 6 Core 2.1 GHz
Memory	32 GiB
Hard Drive	6 x 500 GB
SSD	None
NIC	1 Gb/s



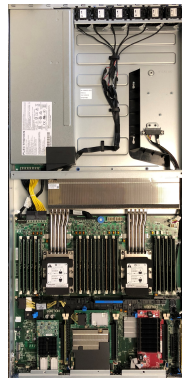
Godzilla	
Processor	2 x 16 Core 2.0 GHz
Memory	512 GiB
Hard Drive	None
SSD	9 x 800 GB
NIC	40 Gb/s



Gen 6	
Processor	2 x Skylake 24 Core 2.7GHz
Memory	768GiB DDR4
Hard Drive	None
SSD	4 x 960 GB M.2 SSDs and 1 x 960 GB SATA
NIC	40 Gb/s + FPGA



Optimized Gen 6	
Processor	2 x 24 core Skylake Lake
Memory	192 GB DDR4
Hard Drive	None
SSD	4 x 960 GB M.2 NVMe
NIC	40 Gb/s + FPGA



Optimized Gen 7	
Processor	2 x 26 core Cascade Lake
Memory	192 GB DDR4
Hard Drive	None
SSD	5 x 960 GB M.2 NVMe
NIC	50 Gb/s + FPGA



Beast	
Processor	4 x 18 Core 2.5 GHz
Memory	4096 GiB
Hard Drive	None
SSD	4 x 2 TB NVMe, 1 x 960 GB SATA
NIC	40 Gb/s



Beast v2	
Processor	8 x 28 Core 2.5 GHz
Memory	12 TiB
Hard Drive	None
SSD	4 x 2 TB NVMe, 1 x 960 GB SATA
NIC	50 Gb/s



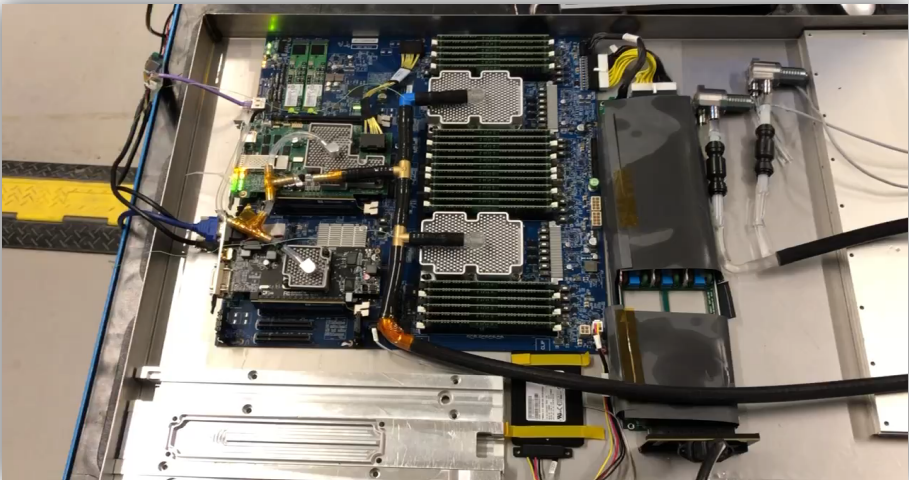
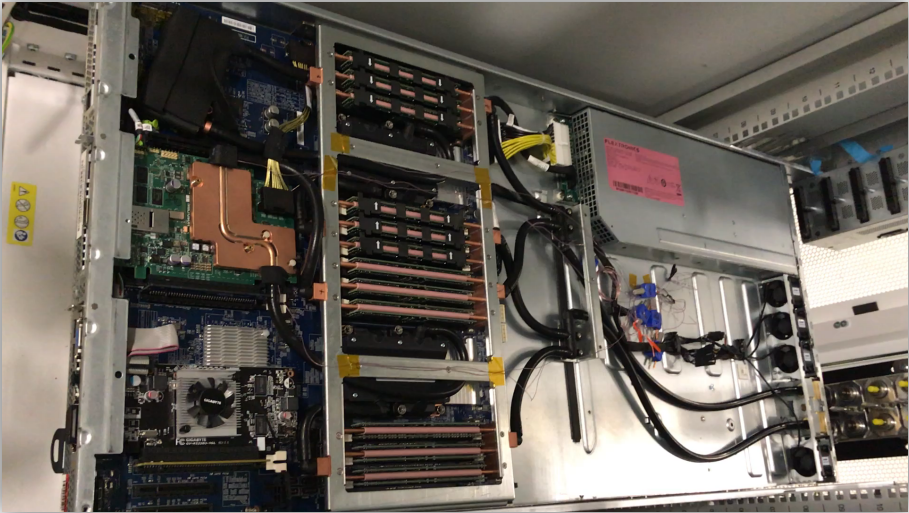
Azure Sphere	
Processor	2 x M4 Core @ 200 MHz
Memory	64KB RAM
WiFi	2.4/5.0 GHz 802.11 b/g/n

# Liquid Cooling : Olympus

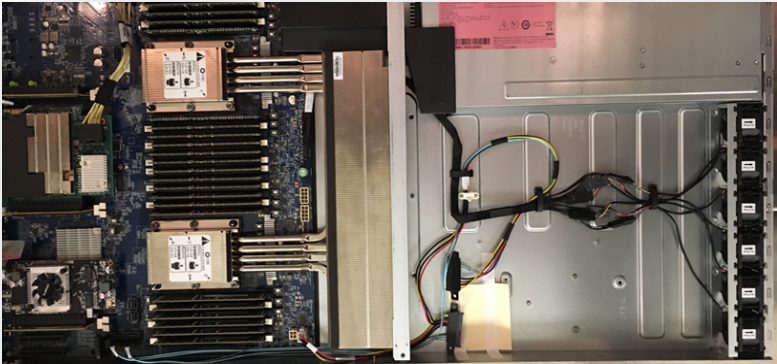
Micro-channel Cold Plates



One phase immersion



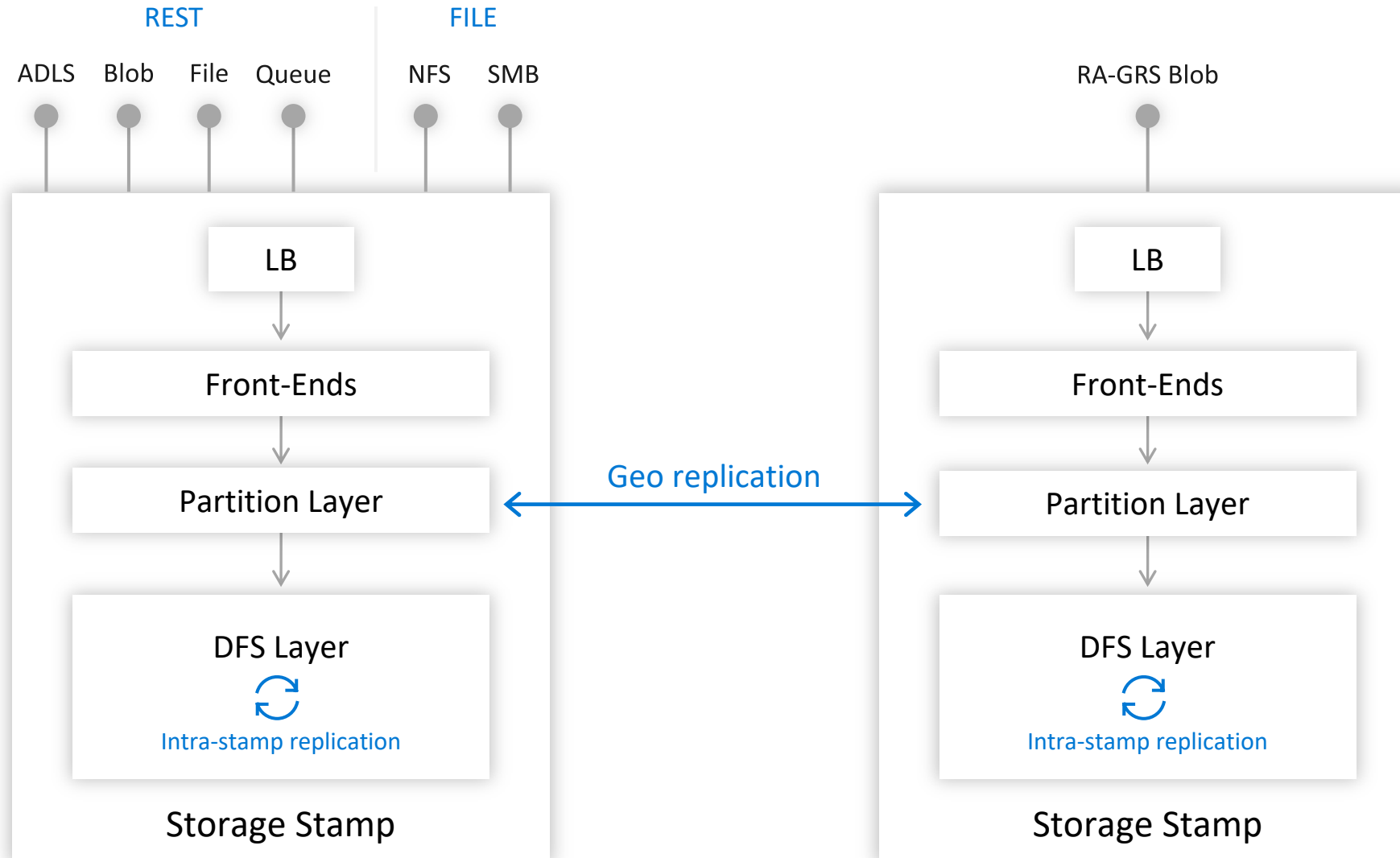
Air Cooled Olympus



Two phase immersion



# Azure Storage architecture





# Big Compute Offerings

## Azure Stack

- **Azure Stack** brings the agility and innovation of cloud computing to on-premises environments. Organizations can now build modern applications across hybrid cloud environments with the right flexibility and control.

## Specialized Compute

- Microsoft Azure offers a wide range of specialized compute infrastructure that allows Oil & Gas companies to **break free from the overhead and limitations of their on-premises** infrastructure and tap into unlimited resources to scale their high-performance computing (HPC) jobs—analyzing large-scale data, running simulations and experiments while reducing time to market

## Azure Batch

- Azure Batch is a platform service for running large-scale parallel and high-performance computing (HPC) applications efficiently in the cloud. Azure Batch schedules compute-intensive work to run on a managed collection of virtual machines, and can **automatically scale compute** resources to meet the needs of your jobs.

## Cycle Cloud

- CycleCloud software suite is the **leading cloud orchestration, provisioning, and data management platform** for Big Compute, Big Data, and large technical computing applications running on any public, private, or internal environment

## Avere File System

- Avere uses an innovative combination of **file system and caching technologies** to support the performance requirements for customers HPC workloads. By bringing together Avere's storage expertise with the power of Microsoft's cloud, customers will benefit from industry-leading innovations that enable the largest, most complex high-performance workloads to run in Microsoft Azure

## Open Source

- Azure continues to aggressively embrace open source technology on Azure. One in four Azure virtual machines runs **Linux** now. This is especially important in HPC workloads since a lot of solutions, applications and workloads require open source industry and research developed libraries for the different applied mathematics employed in HPC.

## Strategic Partnerships

- One of the key differentiator in Oil & Gas and Azure is Microsoft long standing key strategic partnerships in the O&G ecosystem. The company continues to build **significant relationships** with some of the most highly visible Oil & Gas companies and ISV's in the world.
- Our **Cray** partnership is also key for big Oil & Gas customers.

