

Big Compute: HPC on Azure

The performance and scalability of a world-class supercomputing centre is now available to everyone, on demand, in the cloud! Azure provides high memory, High Performance Computing (HPC) resources that enable you to run large parallel and batch compute jobs. Extend your on-premises HPC cluster to the cloud when you need more capacity, or run work entirely in Azure. Scale up and down based upon what you need and pay only for what you use to reduce costs.

Learning Objectives:

This workshop will familiarize you with the “Best Practices” for running Big Compute solutions on Azure and provide you with an opportunity to provision a cluster of machines capable of running parallel workloads.

Target Audience:

People who use HPC (scientists, engineers, developers). People who support HPC (IT infrastructure, architects or sysadmins). Anyone who needs to calculate, simulate, or compute! Linux or Windows. All welcome, but particularly from industries: Finance, Insurance, Manufacturing & Engineering, Life Science, Oil & Gas, Media/Rendering. L300 Hands-On.

Pre-Requisites:

Basic HPC knowledge (people who have worked or are working with HPC). Attendees must bring their own laptop, and have access to an Azure subscription.

Agenda:

Introduction:

(1 hour)

- HPC on Azure (presentation/demo)

Fundamentals:

(3 hours)

- Azure IaaS: My first VM, My first Scale Set
- HPC IaaS: Creating HPC clusters
- HPC PaaS: Azure Batch (Batch AI + Batch Render)

Specifics:

(2 hours)

- Remote Visualisation
- HPC Containers
- Industry examples (Rendering, Genomics, AI)

Labs available online at: <https://github.com/azurebigcompute>



Who are we? (HPC Global Black Belt team, EMEA)



Karl Podesta (IE)
Western Europe

Hugo Meiland (NL)
Western Europe

Mike Kiernan (UK)
United Kingdom

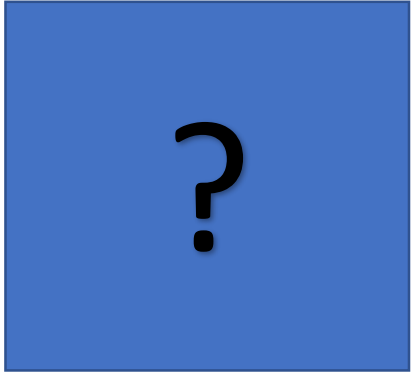
Tomasz Jozefiak (PL)
Central Eastern Europe

Karlheinz Pischke (DE)
Germany

Gabriel Sallah (DB)
Middle East & Africa

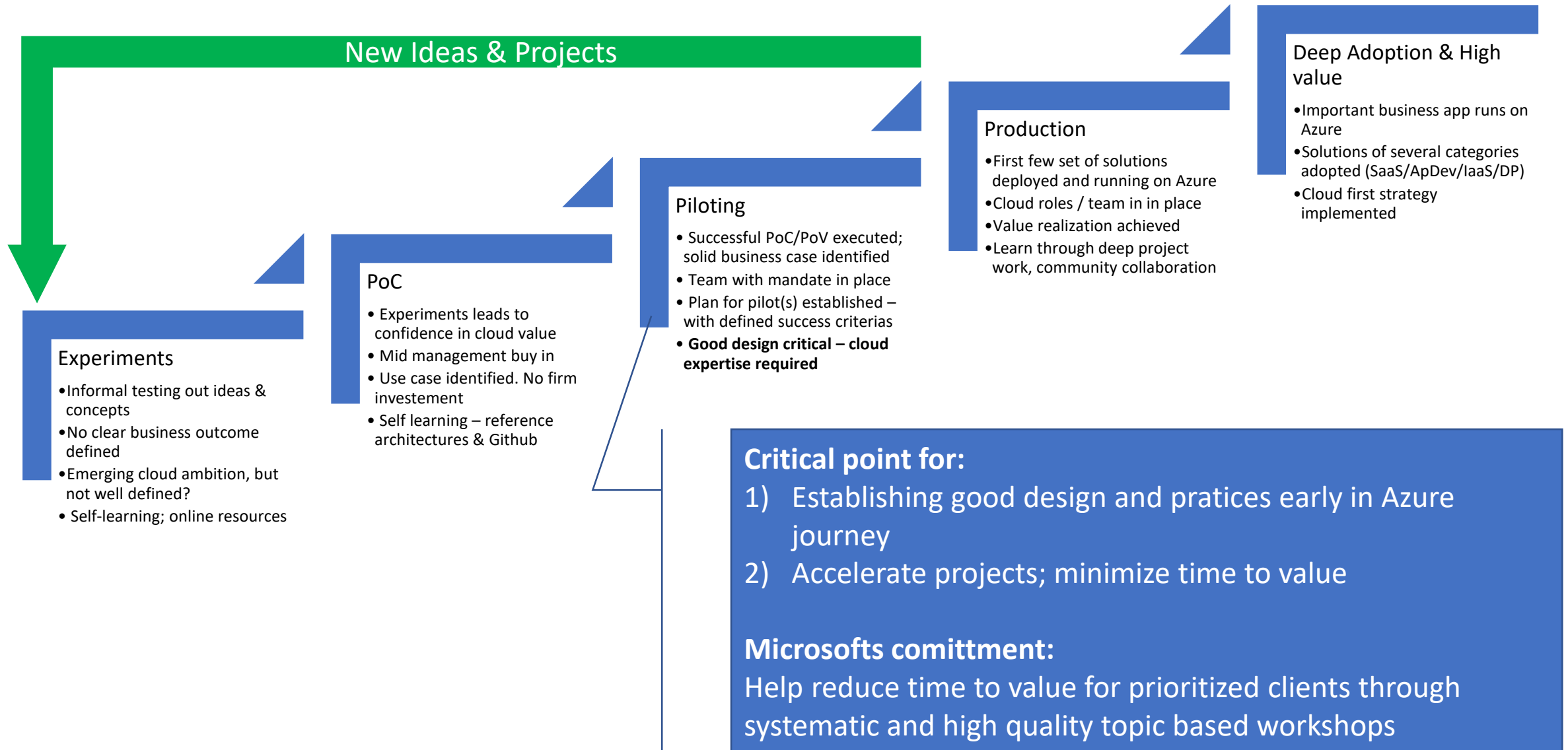
- 15+ years working as a **Linux & HPC techie** (engineer, consultant, trainer, architect, programme manager)
- Worked with **Bloomberg**, **Tullow Oil**, Securelinux, National Institute for Cellular Biotechnology (DCU)
- Certified by **Red Hat** (RHCDSS, RHCSA, RCHE, OpenStack), **SUSE** (CLP/CLE), LPI, Panasas, TOGAF
- 1 year with Microsoft
- Specialist for HPC on Azure
- Helping customers, partners, colleagues
- Doing workshops, presentations, POCs, demos, training – and customer work
- Covering Western Europe (7 countries – Spain, Italy, Portugal, Switzerland, Belgium, Luxembourg, Ireland)
- Helping YOU get what you can from Azure HPC

Who are you?



- Name
- Role
- Company
- What you would like to leave with today?

Azure Adoption Journey



Microsoft Cloud Workshops Menu – Spring 2018

Cloud Infrastructure

SAP@Azure

Big Compute

Azure Stack

Data & AI

Database Modernization
& Migration

Azure Advanced Analytics
& AI

Cognitive Services &
Deep Learning with Azure
Data Services

Spark on Microsoft Azure
Databricks

IoT

Azure IoT Solution Walk
Through

Mobile App Innovation

Mobile Applications
Devops

Data Driven Intelligent
Apps

Application modernization

Modernize your IT with
Red Hat on Azure

Modernize and Cloud-
enable LOB Applications
with Kubernetes &
Microservices

Cloud Adoption Fundamentals: On-boarding, Storage, Networking, Security & Governance

Agenda for Today

Introduction: (1 hr) – presentation/videos/demos

- Why Cloud HPC?
- Why Azure?
- Solution Overview
- Our Partners + their solutions
- Our Customers + industries

Fundamentals: (2-3 hrs) – everyone does these labs

- Azure IaaS – Portal/CLI/PowerShell/SDK (CLI preferred) – create a VM, then create a scale set
- HPC IaaS – Azure ARM or CLI / CycleCloud / Microsoft HPC Pack
- HPC PaaS – Azure Batch

Specifics: (2 hrs) – attendees can choose their lab – some examples below:

- Remote Visualisation (Linux/VNC on NV, running glxgears or other 3D interactive)
- HPC containers (try an example from Batch shipyard, discuss/show Singularity)
- Industry examples (Rendering, Genomics, AI)
- End: Challenges, Guidance, Resources

Introduction



Cloud Workshops 2018
HPC – Big Compute

INTRODUCTION

Why Cloud HPC?

Why Azure?

Our Solutions

Our Partners

Our Customers

Our Value Add

FUNDAMENTALS

SPECIFICS

Why Cloud HPC?

INTRODUCTION

Why Cloud HPC?

Why Azure?

Our Solutions

Our Partners

Our Customers

Our Value Add

FUNDAMENTALS

SPECIFICS

Heard about Big Data? ... What about Big Compute?

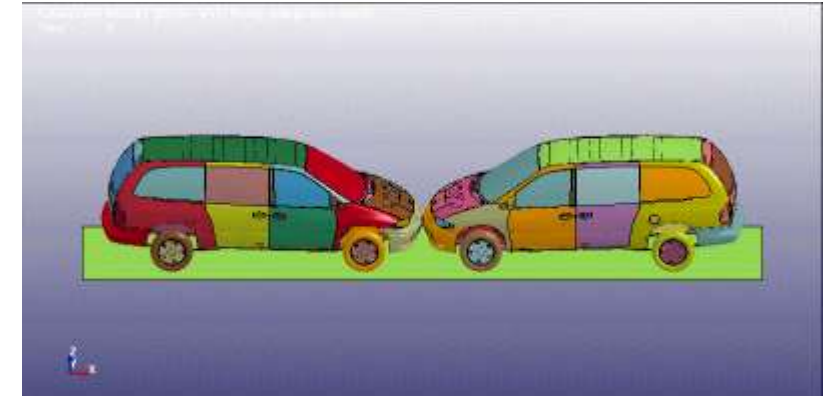


How can our banks understand risk? Can we have safer cars?

How will global weather change affect us? Can we find & cure disease?

We use High Performance Computing (HPC) to **compute, simulate, learn, predict**

Cloud HPC is about doing even more....



Brady Holt
(https://commons.wikimedia.org/wiki/File:1997_Pontiac_Trans_Sport_SE_IIHS.jpg), „1997 Pontiac Trans Sport SE IIHS“,
<https://creativecommons.org/licenses/by/3.0/legalcode>

.... by many more. The cloud brings HPC to everyone!

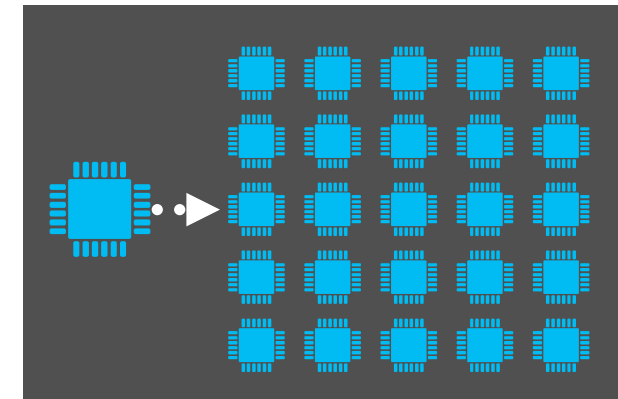
What would you do with 100x the scale?

Would you do more?

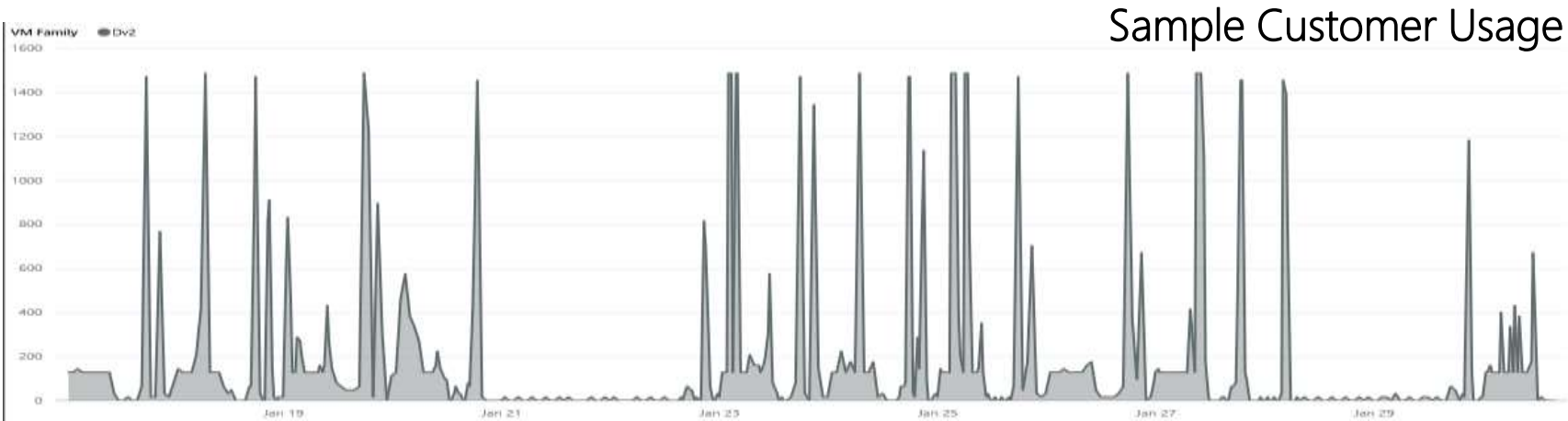
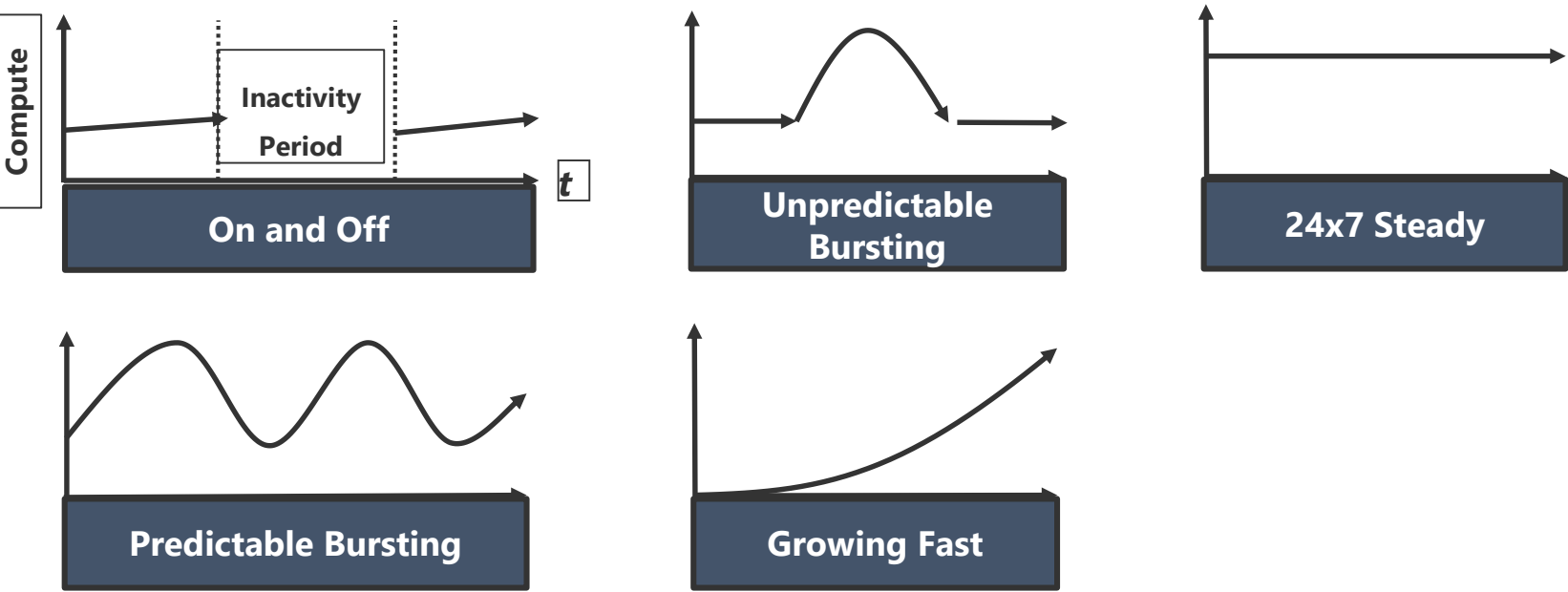
- Service more users?
- Run more projects?
- Run larger simulations?
- Get results faster?
- Explore new insights?

Would you remove limitations?

- Modify more parameters?
- Analyse more complex models?
- Visualise larger results?
- Run more iterations?
- Generate higher fidelity results?



Bursting & Workload Management

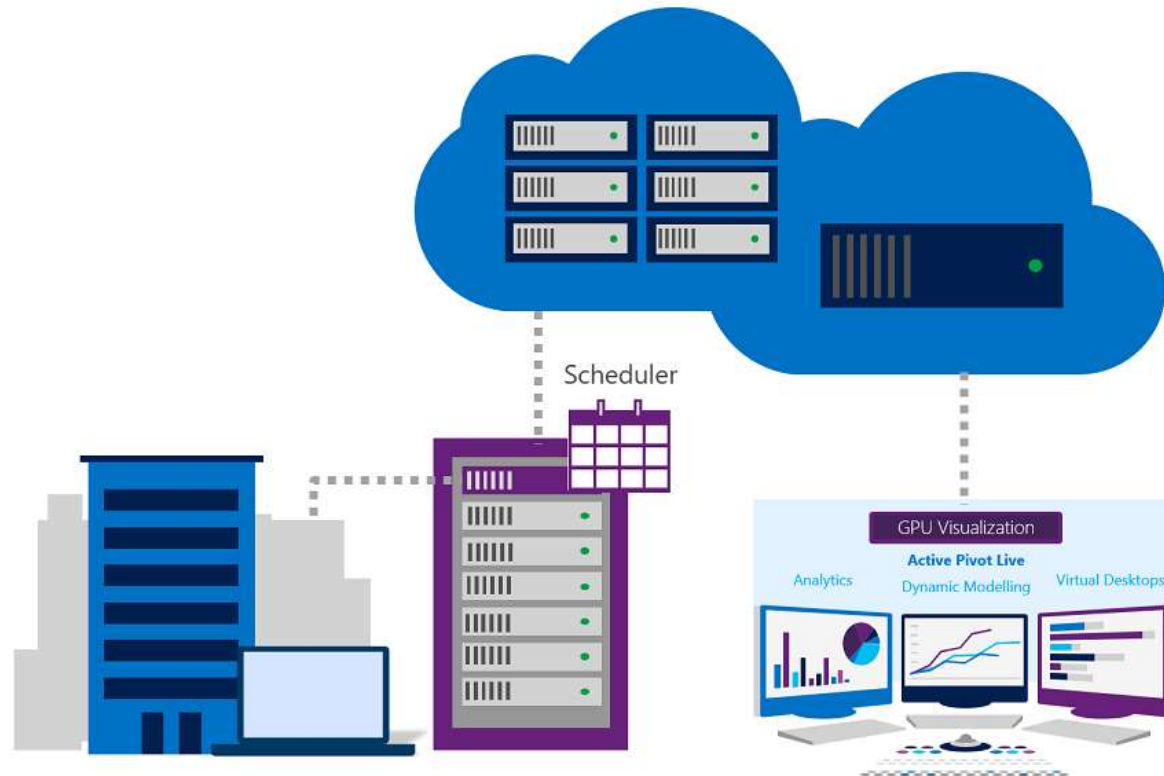


Hybrid HPC – complement your capability

What you need, when you need it

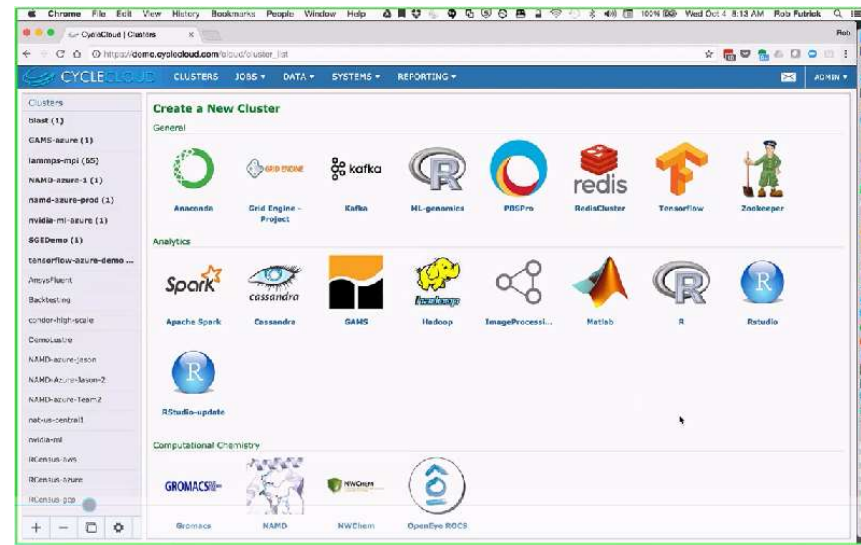
Expand your existing capability

Collaborate better across locations; let users come to cloud to see & work with results

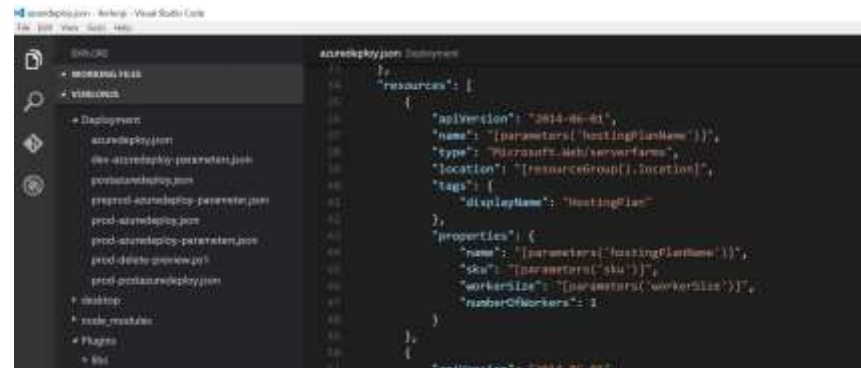


Next Generation HPC – thinking differently with public cloud

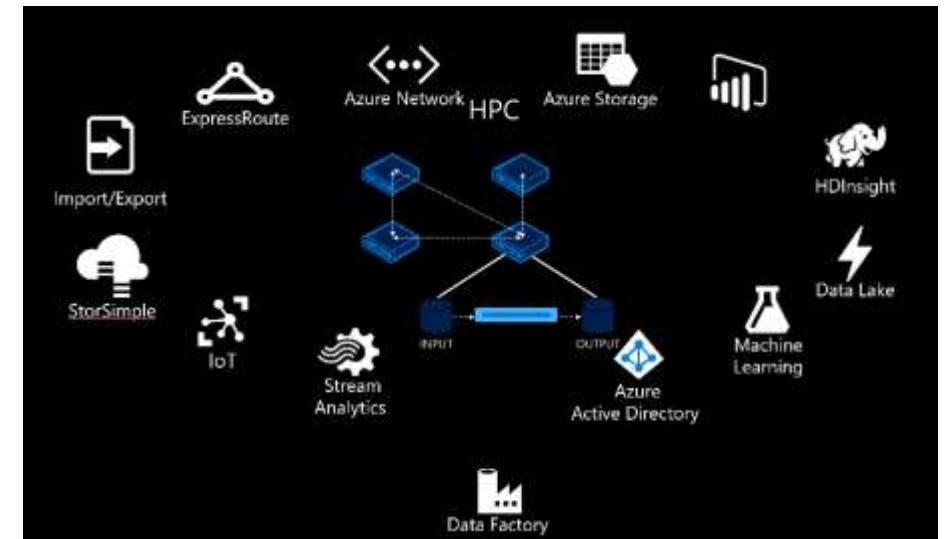
“A cluster (cloud!) for every HPC workload”



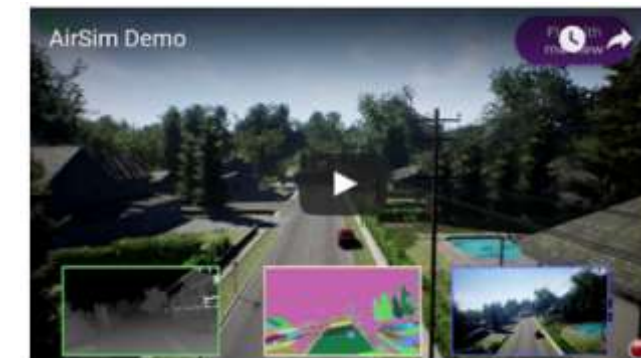
“HPC Infrastructure as code”



“HPC is one building block”



“AI, ML, Data Analytics”



Cloud Workshops 2018
HPC – Big Compute

INTRODUCTION

Why Cloud HPC?

Why Azure?

Our Solutions

Our Partners

Our Customers

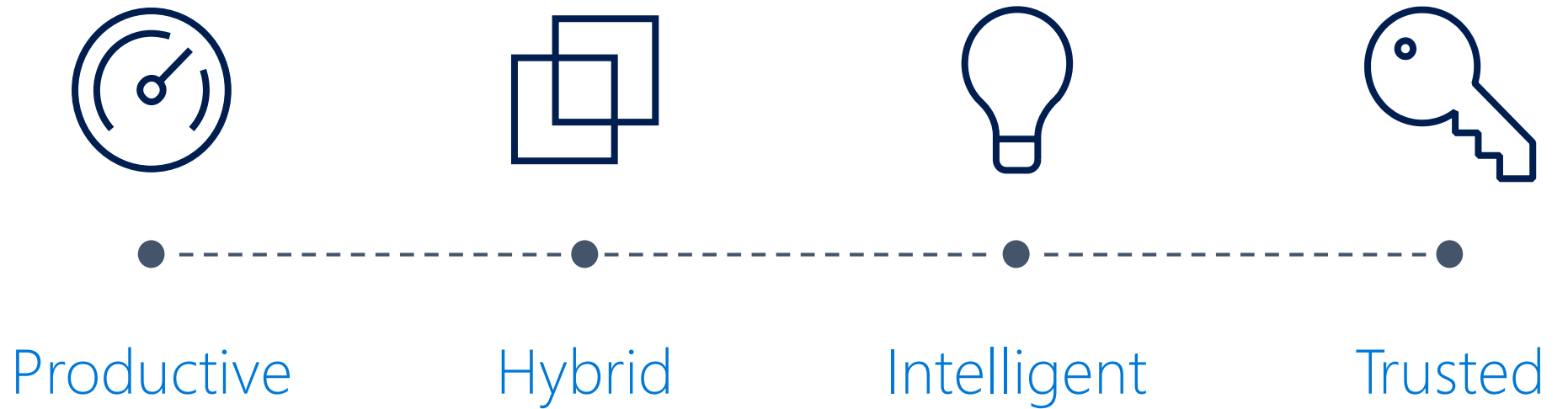
Our Value Add

FUNDAMENTALS

SPECIFICS

Why Azure?

Proof points – the reasons customers choose us



Productive – build & innovate with choice and flexibility

DevOps		Nagios	VAGRANT		GRUNT				Xamarin	
Management	CHEF	puppet	ANSIBLE	SALTSTACK			mist.io	libcloud		SCALR
Applications		Joomla!	Drupal		APPREND					
App frameworks & tools	php	nodeJS		JS	Ruby		eclipse			
Databases & middleware		redis	CLEARDB	cloudera	MySQL	mongoDB		Couchbase		
Infrastructure			redhat	suse		bitnami	ORACLE LINUX	FreeBSD		



Integrated tooling

Visual Studios
3rd parties | DevOps



100+ services

Azure functions
Kubernetes | Logic apps



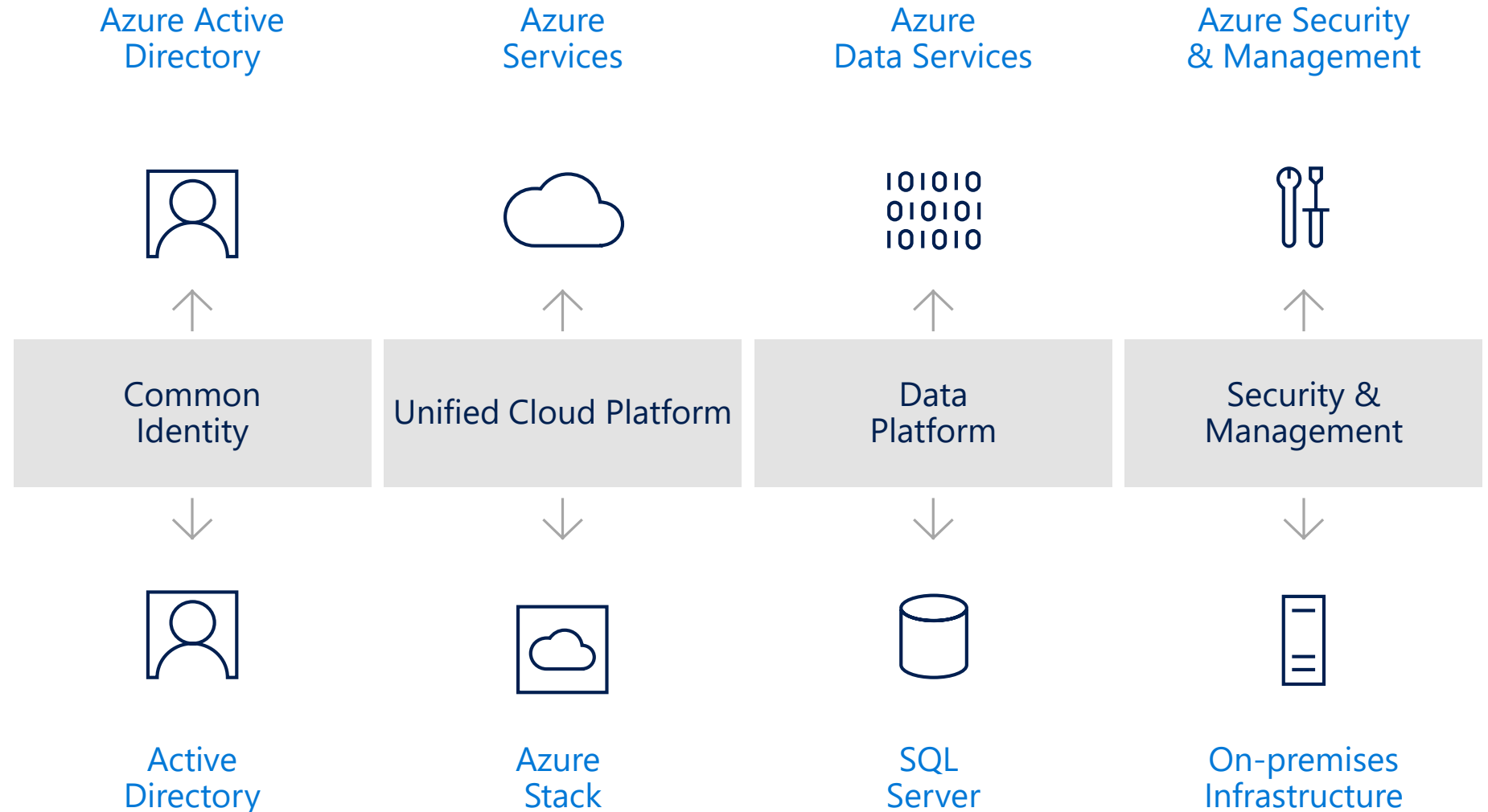
Unified management

Single cloud | Policy

4000+
solutions
in Azure
Market-
Place



Hybrid – the only consistent, hybrid cloud



INTRODUCTION

Why Cloud HPC?

Why Azure?

Our Solutions

Our Partners

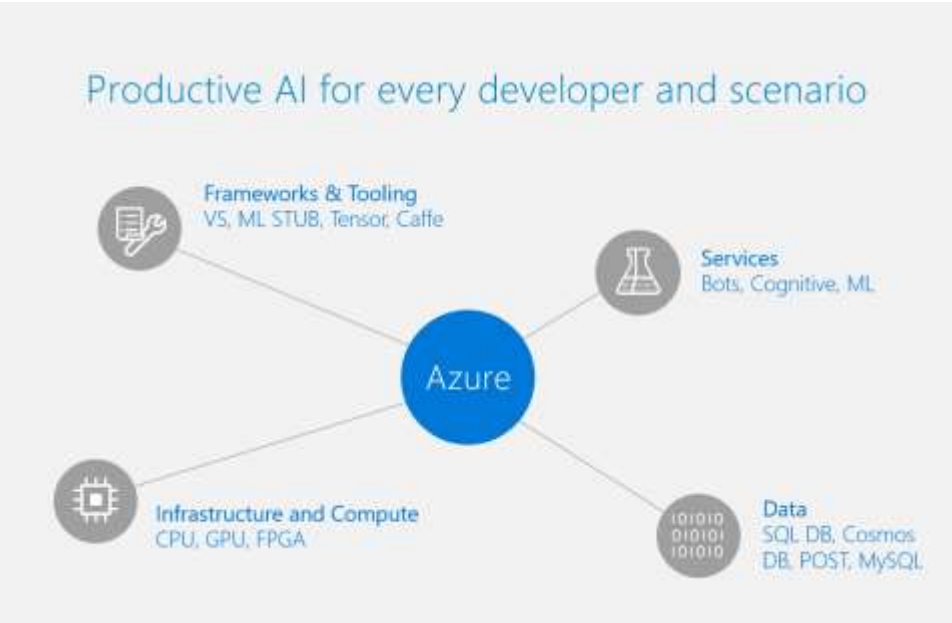
Our Customers

Our Value Add

FUNDAMENTALS

SPECIFICS

Intelligent – Data, AI, Frameworks, Services, IoT



Vision

From faces to feelings, allow apps to understand images and video

Show me what is in the image

Policy violations: Jackhammer - anti-theft orientation detected in the workshop

Speech

Hear and speak to users by filtering noise, identifying speakers, and understanding intent

Convert this text to speech please...

Language

Process text and learn how to recognize what users want

Play today's conference call...

Natural Language Processing

Intent: PlayCall
Context: Customer#
DateTime: date: today

Now Playing

11/23/2016 Customer Call

Knowledge

Tap into rich knowledge amassed from the web, academia, or your own data

Top publications in AI...

Patents: Algorithms in Search, Optimization, Learning, and Hard Learning

Publication of Decision Trees, Tree Boosting, and Ensemble Learning

Advances in Artificial Intelligence, Machine Learning, and Deep Learning

Outline of a New Approach to the Analysis of Complex Systems and Decision Processes

100,000+ Computer Science and Engineering Publications

Search

Locate relevant information among billions of web pages, images, videos, and news with Bing APIs

Fraud prevention results...

How do their victims' most recent documents or benefits?

Credit card fraud

Phone or utility fraud

Bank fraud

Employment-related fraud

Assumed identity theft

Loan fraud

Other



INTRODUCTION

Why Cloud HPC?

Why Azure?

Our Solutions

Our Partners

Our Customers

Our Value Add

FUNDAMENTALS

SPECIFICS

Trusted – 71+ compliance offerings

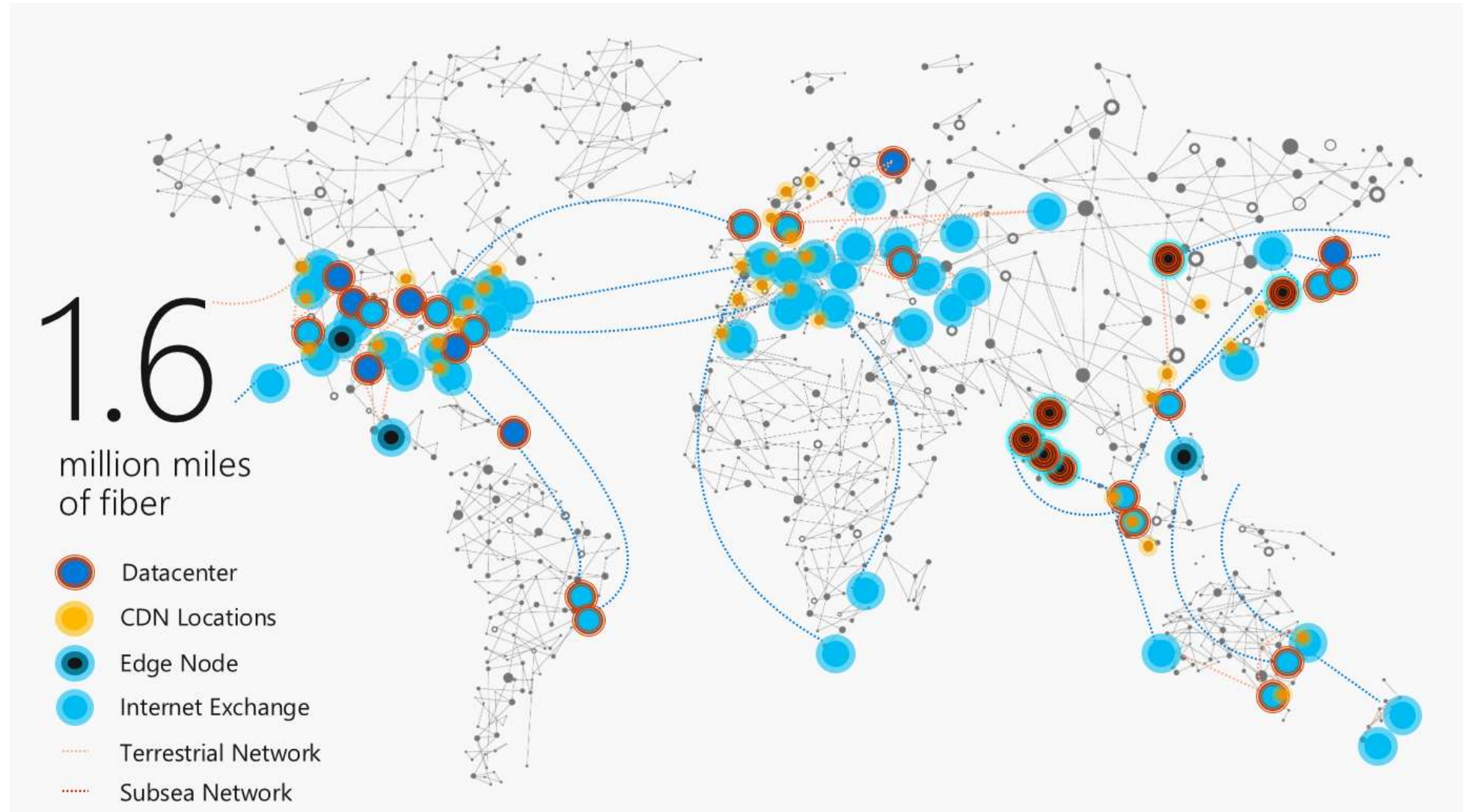
Global	<input checked="" type="checkbox"/> ISO 27001:2013 <input checked="" type="checkbox"/> ISO 27017:2015 <input checked="" type="checkbox"/> ISO 27018:2014	<input checked="" type="checkbox"/> ISO 22301:2012 <input checked="" type="checkbox"/> ISO 9001:2015 <input checked="" type="checkbox"/> ISO 20000-1:2011	<input checked="" type="checkbox"/> SOC 1 Type 2 <input checked="" type="checkbox"/> SOC 2 Type 2 <input checked="" type="checkbox"/> SOC 3	<input checked="" type="checkbox"/> CSA STAR Certification <input checked="" type="checkbox"/> CSA STAR Attestation <input checked="" type="checkbox"/> CSA STAR Self-Assessment <input checked="" type="checkbox"/> WCAG 2.0
US Gov	<input checked="" type="checkbox"/> FedRAMP High <input checked="" type="checkbox"/> FedRAMP Moderate <input checked="" type="checkbox"/> EAR	<input checked="" type="checkbox"/> DoD DISA SRG Level 5 <input checked="" type="checkbox"/> DoD DISA SRG Level 4 <input checked="" type="checkbox"/> DoD DISA SRG Level 2 <input checked="" type="checkbox"/> DFARS	<input checked="" type="checkbox"/> DoE 10 CFR Part 810 <input checked="" type="checkbox"/> NIST SP 800-171 <input checked="" type="checkbox"/> NIST CSF <input checked="" type="checkbox"/> Section 508 VPATs	<input checked="" type="checkbox"/> FIPS 140-2 <input checked="" type="checkbox"/> ITAR <input checked="" type="checkbox"/> CJIS <input checked="" type="checkbox"/> IRS 1075
Industry	<input checked="" type="checkbox"/> PCI DSS Level 1 <input checked="" type="checkbox"/> GLBA <input checked="" type="checkbox"/> FFIEC <input checked="" type="checkbox"/> Shared Assessments <input checked="" type="checkbox"/> FISC (Japan)	<input checked="" type="checkbox"/> FCA (UK) <input checked="" type="checkbox"/> MAS + ABS (Singapore) <input checked="" type="checkbox"/> 23 NYCRR 500 <input checked="" type="checkbox"/> HIPAA BAA <input checked="" type="checkbox"/> HITRUST	<input checked="" type="checkbox"/> 21 CFR Part 11 (GxP) <input checked="" type="checkbox"/> MARS-E <input checked="" type="checkbox"/> NHS IG Toolkit (UK) <input checked="" type="checkbox"/> NEN 7510:2011 (Netherlands) <input checked="" type="checkbox"/> FERPA	<input checked="" type="checkbox"/> CDSA <input checked="" type="checkbox"/> MPAA <input checked="" type="checkbox"/> FACT (UK) <input checked="" type="checkbox"/> DPP (UK) <input checked="" type="checkbox"/> SOX
Regional	<input checked="" type="checkbox"/> Argentina PDPA <input checked="" type="checkbox"/> Australia CCSL / IRAP <input checked="" type="checkbox"/> Canada Privacy Laws <input checked="" type="checkbox"/> China GB 18030:2005 <input checked="" type="checkbox"/> China DJCP (MLPS) Level 3	<input checked="" type="checkbox"/> China TRUCS / CCCPPF <input checked="" type="checkbox"/> EN 301 549 <input checked="" type="checkbox"/> EU ENISA IAF <input checked="" type="checkbox"/> EU Model Clauses <input checked="" type="checkbox"/> EU – US Privacy Shield <input checked="" type="checkbox"/> Germany IT-Grundschutz workbook	<input checked="" type="checkbox"/> Germany CS <input checked="" type="checkbox"/> India MeitY <input checked="" type="checkbox"/> Japan CS Mark Gold <input checked="" type="checkbox"/> Japan My Number Act <input checked="" type="checkbox"/> Netherlands BIR 2012 <input checked="" type="checkbox"/> New Zealand Gov CIO Fwk	<input checked="" type="checkbox"/> Singapore MTCS Level 3 <input checked="" type="checkbox"/> Spain ENS <input checked="" type="checkbox"/> Spain DPA <input checked="" type="checkbox"/> UK Cyber Essentials Plus <input checked="" type="checkbox"/> UK G-Cloud <input checked="" type="checkbox"/> UK PASF

<https://aka.ms/AzureCompliance>

We are **Global** – more locations than anyone else (& growing)



We are **Global** – more locations than anyone else (& growing)



INTRODUCTION

Why Cloud HPC?

Why Azure?

Our Solutions

Our Partners

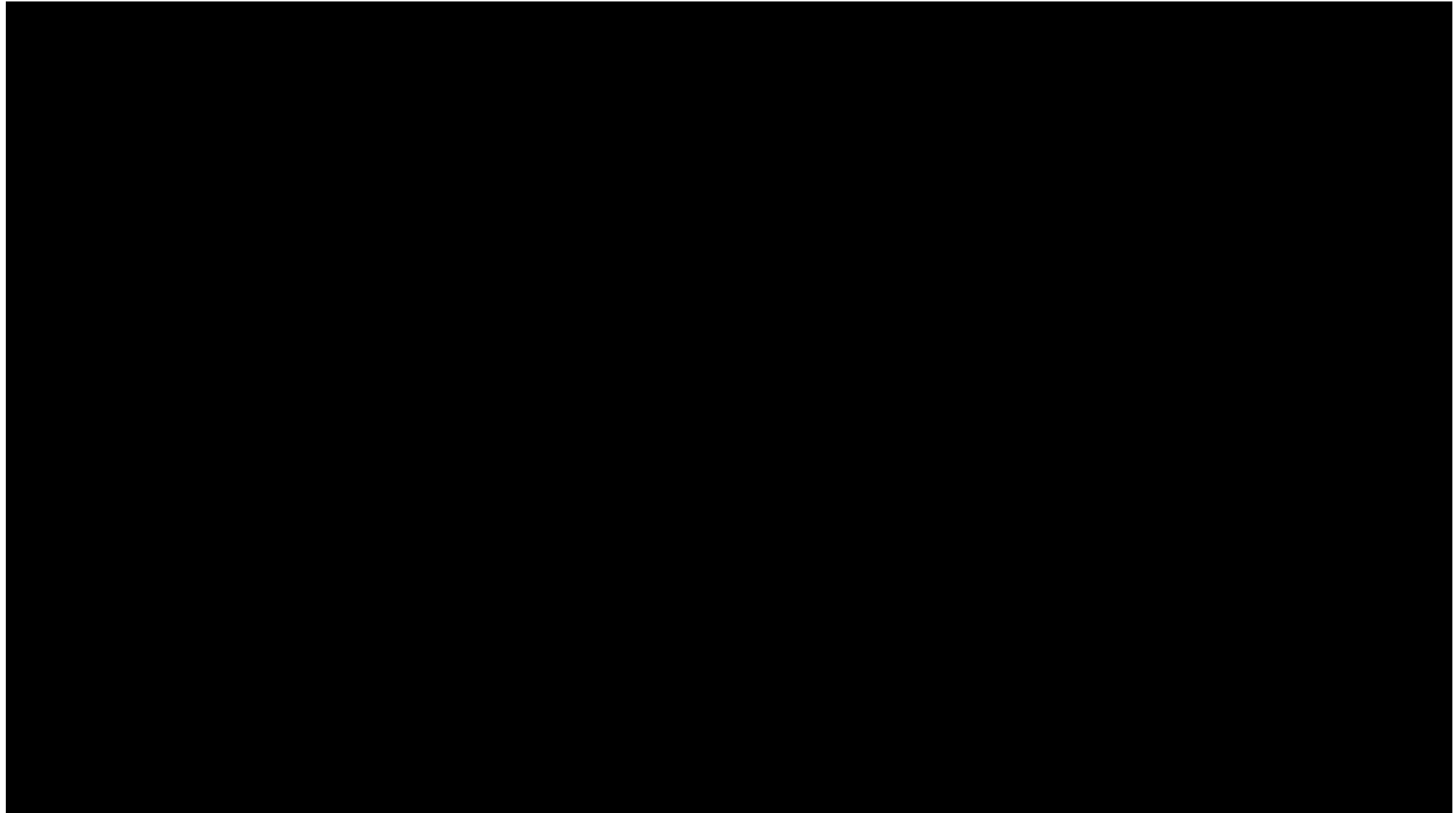
Our Customers

Our Value Add

FUNDAMENTALS

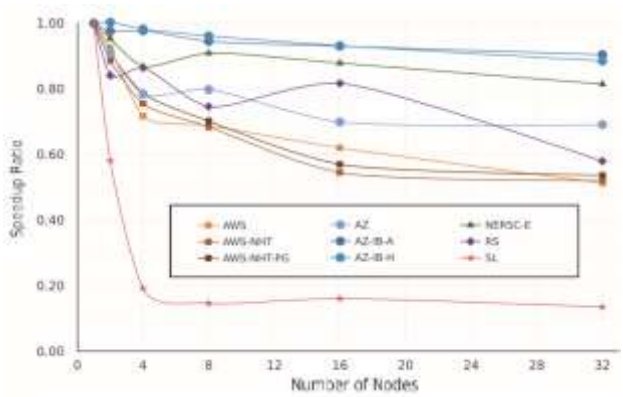
SPECIFICS

Azure Datacentres video – 1 min 30 sec



We Scale

Proper supercomputer-class scaling



Source: Mohammadi, M., Bazhirov, T. (Feb 9, 2017) Exabyte Inc. "Comparative benchmarking of cloud computing vendors with High Performance Linpack"
(<https://arxiv.org/pdf/1702.02968.pdf>)

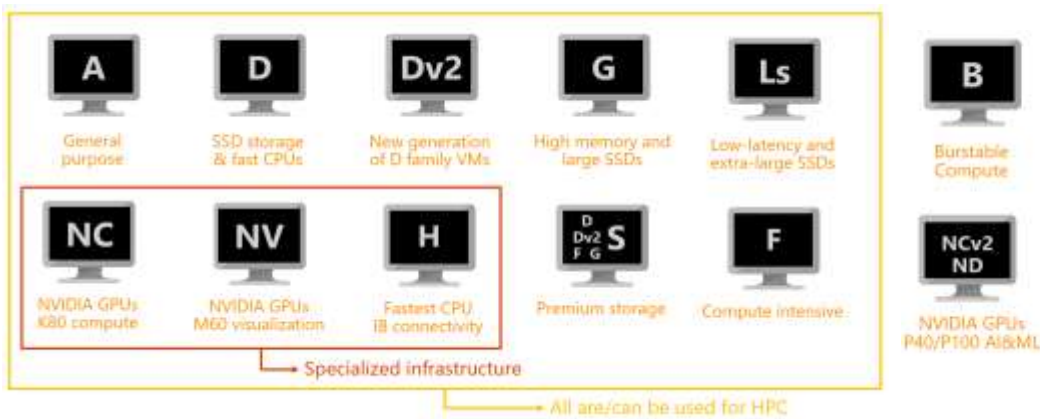


Spinning up 16000 A1 VMs on Azure Batch

<https://blogs.endjin.com/2015/07/spinning-up-16000-a1-virtual-machines-on-azure-batch/>

We Perform

Choose to optimise for CPU, RAM, Disk, Network, Cost



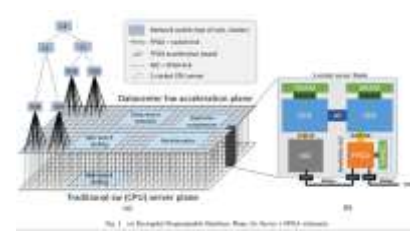
GPUs (NC, NV, ND)



Infiniband Networking



FPGA Networking



Cloud Workshops 2018
HPC – Big Compute

INTRODUCTION

Why Cloud HPC?

Why Azure?

Our Solutions

Our Partners

Our Customers

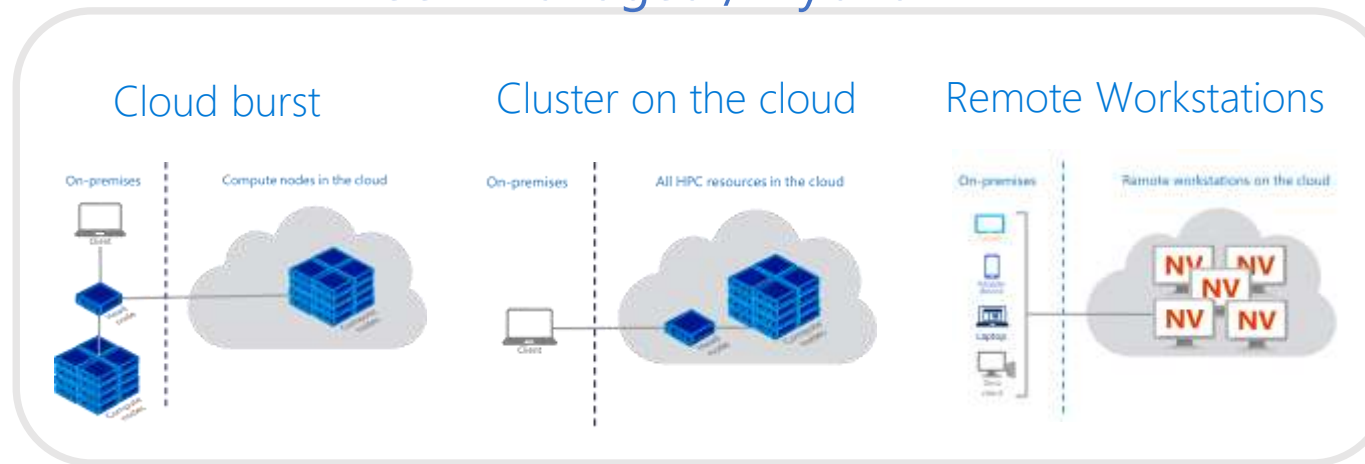
Our Value Add

FUNDAMENTALS

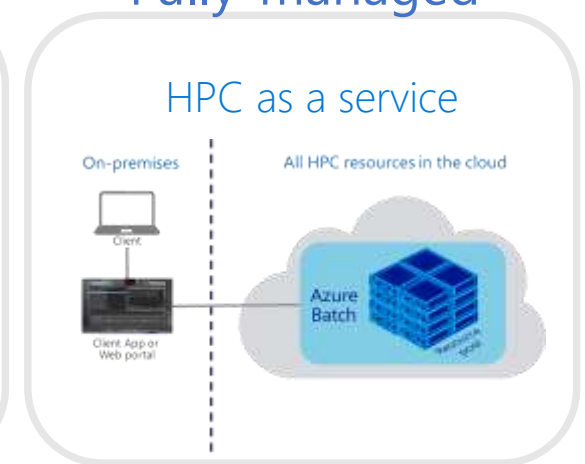
SPECIFICS

Solution Overview

Self-managed / Hybrid



Fully-managed



Add cloud resources to your cluster, on demand

- Burst to cloud to add resources when needed
- Continue using your existing on-premises infrastructure
- Run workloads on Windows and Linux, on Azure and on-premises
- Cover peaks in demand or special projects
- Pay only for what you use
- [Microsoft HPC Pack](#), [Univa Grid Engine](#), and [Altair PBS Pro](#) already have this capability (and more are coming!)

Provision one (or more) new clusters in minutes

- Deploy a complete HPC cluster, all in the cloud, in just minutes
- Use templates, scripts, and images to quickly deploy at any scale
- Use your current HPC scheduler
- Shift existing applications, scripts and tools to cloud
- Deploy as many clusters as you need!

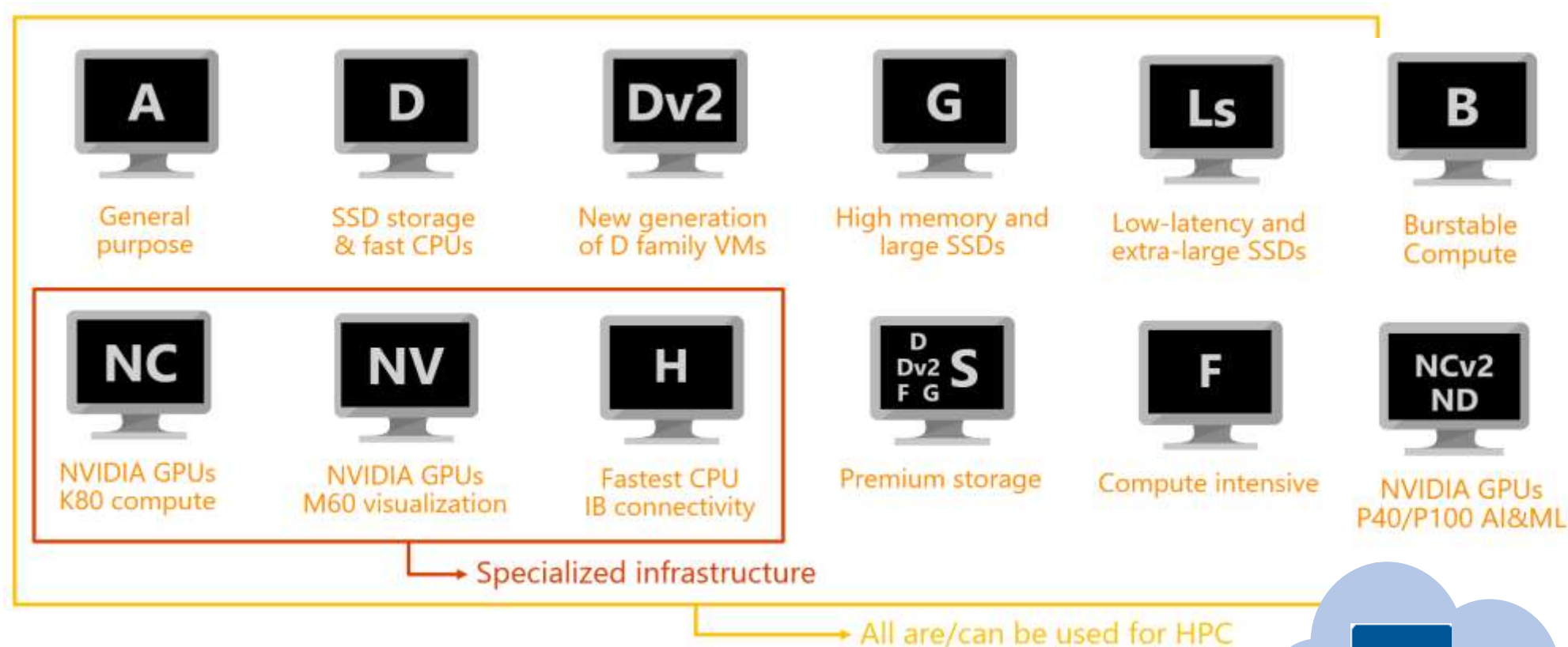
Deploy powerful GPU-enabled workstations

- Deploy one or more GPU-enabled workstations on the cloud
- Connect from any laptop or device (iOS, Android, Windows)
- Collaborate, share, explore.
- With or without optimized remote visualization platforms (e.g., Teradici PCoIP or Citrix HDX)

Run at scale directly from your application

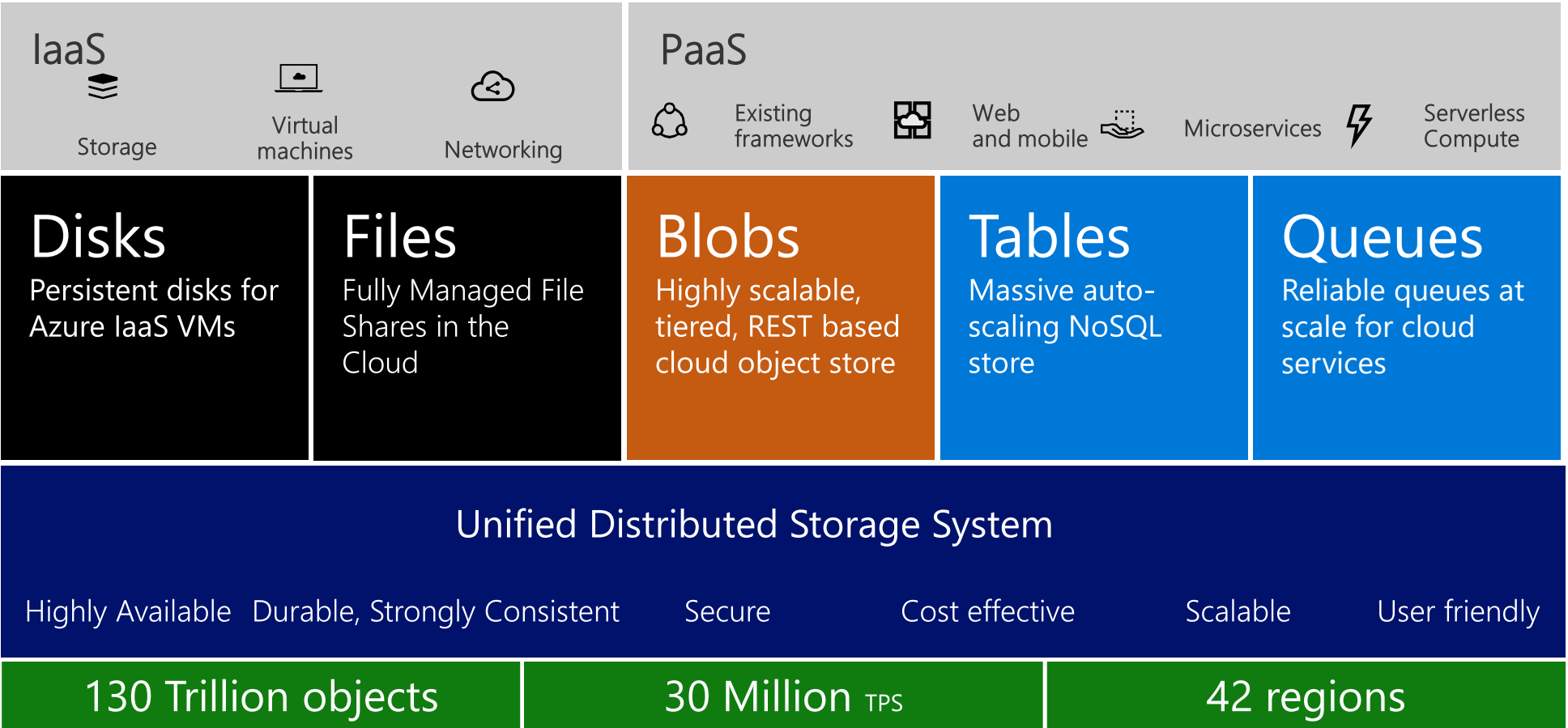
- Integrate with Azure Batch, directly from a client application (GUI or CLI) or online portal
- Batch abstracts resource management and scheduling completely
- Supports small to extremely large deployments and can deploy any VM size
- Provides auto-scaling and stopping of resources
- Run HPC jobs at scale on Docker containers
- Using Batch is free, you only pay for the underlying compute!

Azure Compute



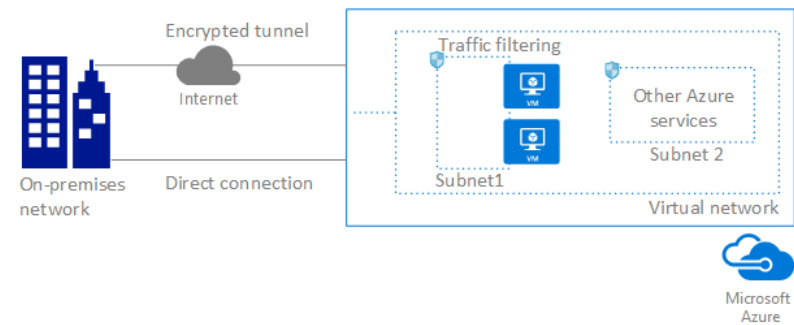
- Reserved Instances (1-year & 3-year)
- Low Priority Instances
- Pay as you go Instances

Azure Storage

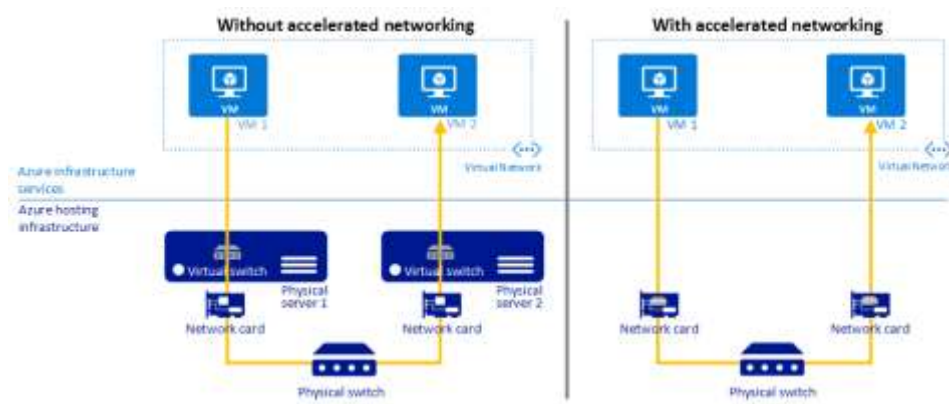


Azure Networking

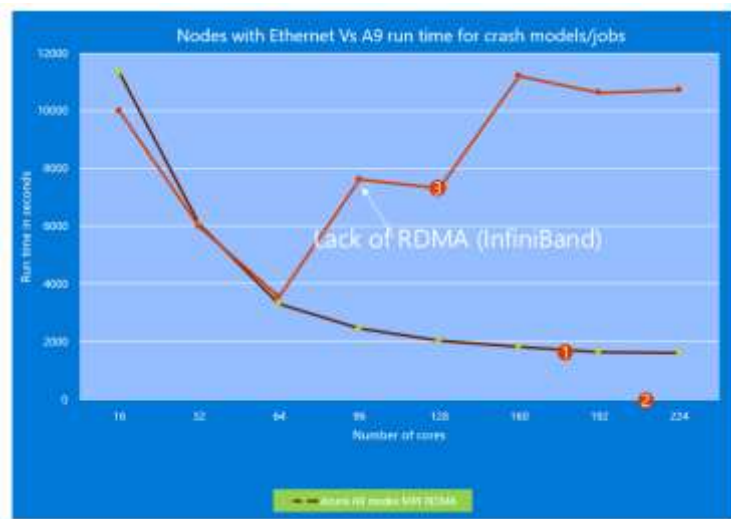
Networking Basics



Accelerated Networking between VMs



Infiniband Networking: true HPC networks



INTRODUCTION

Why Cloud HPC?

Why Azure?

Our Solutions

Our Partners

Our Customers


Our Value Add

FUNDAMENTALS

SPECIFICS

Azure all up.... 100+ services

Web & Mobile

 Web Apps	 Mobile Apps
 Logic Apps	 API Apps
 Content Delivery Network	 Media Services
 Search	

Container Services

 Azure Container Service	 Azure Container Registry
---	--








Databases

 SQL Database	 SQL Data Warehouse
 SQL Server Stretch Database	 DocumentDB
 Redis Cache	 Data Factory

Data & Analytics

 HDInsight	 Machine Learning
 Cognitive Services	 Azure Bot Service*
 Data Lake Analytics	 Power BI Embedded
 Azure Analysis Services	

Internet of Things (IoT)

 Azure IoT Hub	 Event Hubs
 Stream Analytics	 Notification Hubs
 BizTalk Services	 Service Bus
 Data Catalog	



Security & Identity

 Security Center	 Key Vault
 Azure Active Directory	 B2C
 Domain Services	 Multi-Factor Authentication

Developer Tools

 Visual Studio Team Services	 Azure DevTest Labs
 VS Application Insights	 API Management
 HockeyApp	 Developer Tools
 Service Profiler*	

Monitoring & Management

 Azure Portal	 Azure Resource Manager
 Azure Advisor	 Azure Monitor
 Log Analytics	 Automation
 Scheduler	

INTRODUCTION

Why Cloud HPC?

Why Azure?

Our Solutions

Our Partners

Our Customers

Our Value Add

FUNDAMENTALS

SPECIFICS

Build in intelligence with AI: our Cognitive Services API

Vision

From faces to feelings, allow apps to understand images and video

Show me what is in the image

Policy violation: Jackhammer unstable orientation detected in the workshop

Speech

Hear and speak to users by filtering noise, identifying speakers, and understanding intent

Convert this text to speech please...

Language

Process text and learn how to recognize what users want

Play today's conference call...

Natural Language Processing

Intent: PlayCall
Content: Customer#
DateTime.date: today

Now Playing

11/29/2016 Customer Call

Knowledge

Tap into rich knowledge amassed from the web, academia, or your own data

Top publications in AI...

Genetic Algorithms in Search, Optimization Learning
1989, David E Goldberg
Cited 18,910 times

Induction of Decision Trees
1986, Machine Learning
J R Quinlan
Decision tree expert system machine learning computer
Cited 4,819 times

Outline of a New Approach to the Analysis - Systems and Decision Processes
1973, IEEE Transactions on Systems, Man, and Cybernetics, 100
Lotfi A Zadeh (University Of California Berkeley)
fuzzy set complex systems artificial neural network computer
machine learning artificial intelligence computer science
Cited 2,402 times

Search

Locate relevant information among billions of web pages, images, videos, and news with Bing APIs

Fraud prevention results...

How ID theft victims' in

nment documents or benefits	
Credit card fraud	
Phone or utilities fraud	
Bank fraud	8.1%
Employment-related fraud	4.8%
Attempted identity theft	4.8%
Loan fraud	4.4%
Other	

sion Consumer Sentinel Network Data Book,

INTRODUCTION

Why Cloud HPC?

Why Azure?

Our Solutions

Our Partners

Our Customers

Our Value Add

FUNDAMENTALS

SPECIFICS

Simplify IoT with Pre-configured solutions



Azure IoT Suite

- Device connectivity & management
- Data ingestion and command & control
- Stream processing & predictive analytics
- Workflow automation and integration
- Dashboards and visualization
- Preconfigured solutions
 - Remote monitoring
 - Predictive maintenance
 - Connected factory (new)

Cloud Workshops 2018
HPC – Big Compute

INTRODUCTION

Why Cloud HPC?

Why Azure?

Our Solutions

Our Partners

Our Customers

Our Value Add

FUNDAMENTALS

SPECIFICS

Doing it together: our partners

We Partner and we Work Together



- > 2 weeks, from concept to completion
- > Accessing 50,000 cores
- > 30 years of compute in 6 hours for less than \$5,000

"Azure basically gives us a solid, rock solid performance - no questions asked."

—Rolf Seuster, HEPnet Technical Manager
University of Victoria

"We believe that the Siemens teamplay framework and Microsoft Azure platform offer the potential to fundamentally change the way healthcare services are delivered."

—Robert Day, Chief Operating Officer
Zwanger – Pesiri Radiology

"We can spin up virtual machines when we need them, and we don't have to pay for them otherwise. Pay-as-you-go is really important to minimizing our costs."

—Jussi Mattila, Head of Research and Development
Combinostics

Cloud Workshops 2018
HPC – Big Compute

INTRODUCTION

Why Cloud HPC?

Why Azure?

Our Solutions

Our Partners

Our Customers

Our Value Add

FUNDAMENTALS

SPECIFICS

What have others done? Our Customers

INTRODUCTION

Why Cloud HPC?

Why Azure?

Our Solutions

Our Partners

Our Customers

Our Value Add

FUNDAMENTALS

SPECIFICS

Bar Ilan Experiment – Cryptanalysis Research



INTRODUCTION

Why Cloud HPC?

Why Azure?

Our Solutions

Our Partners

Our Customers

Our Value Add

FUNDAMENTALS

SPECIFICS

Insurance – modelling complex natural disasters with HPC

Global insurance firm models complex natural disasters with cloud-based HPC

AXA Global P&C manages reinsurance programs for the AXA Group, a global insurance provider based in Paris, France. To create complex catastrophe models for floods and other natural disasters, a team of actuaries created a high-performance computing (HPC) solution based on the Microsoft Azure platform and Azure HPC Pack. Now, AXA Group can improve insurance services with more accurate, detailed information about events ranging from floods to hurricanes.



Products and Services

Azure Batch
Azure Storage
Azure Virtual Machines
Microsoft HPC Pack

Organization Size

165,000
employees

Industry

Insurance

Country

France

Business Need

Business agility



INTRODUCTION

Why Cloud HPC?

Why Azure?

Our Solutions

Our Partners

Our Customers

Our Value Add

FUNDAMENTALS

SPECIFICS

Advancing Scientific Research



Cloud Workshops 2018
HPC – Big Compute

INTRODUCTION

Why Cloud HPC?

Why Azure?

Our Solutions

Our Partners

Our Customers

Our Value Add

FUNDAMENTALS

SPECIFICS

Karl Podesta (@karlpodesta)
kapodest@microsoft.com
<https://github.com/azurebigcompute>

Our Value Add: Microsoft Research

We Research and we Add Value

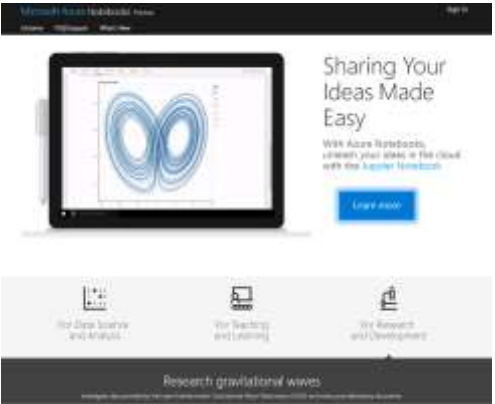
Grants for non-profit research



Microsoft Genomics Service



Azure Notebooks



We will bring Quantum to everyone



Top contributors on GitHub; Solutions/Recipes shared



Fundamentals

- Azure IaaS
- HPC IaaS
- HPC PaaS
- HPC SaaS



Pre-Requisites

Getting Access:

- Azure Pass – <https://www.microsoftazurepass.com>
- Free Account – <https://azure.microsoft.com/free>
- OR – your own company's Azure account

Ways to Access:

- Azure Portal – <https://portal.azure.com>
- Azure CLI – Windows/Linux/Mac – az cli
- PowerShell
- Code: SDK (Java, C#, Python, etc)

Changing core quota:

- Raise a support ticket in Azure portal

Cloud Workshops 2018
HPC – Big Compute

INTRODUCTION

FUNDAMENTALS

Azure IaaS

HPC IaaS

HPC PaaS

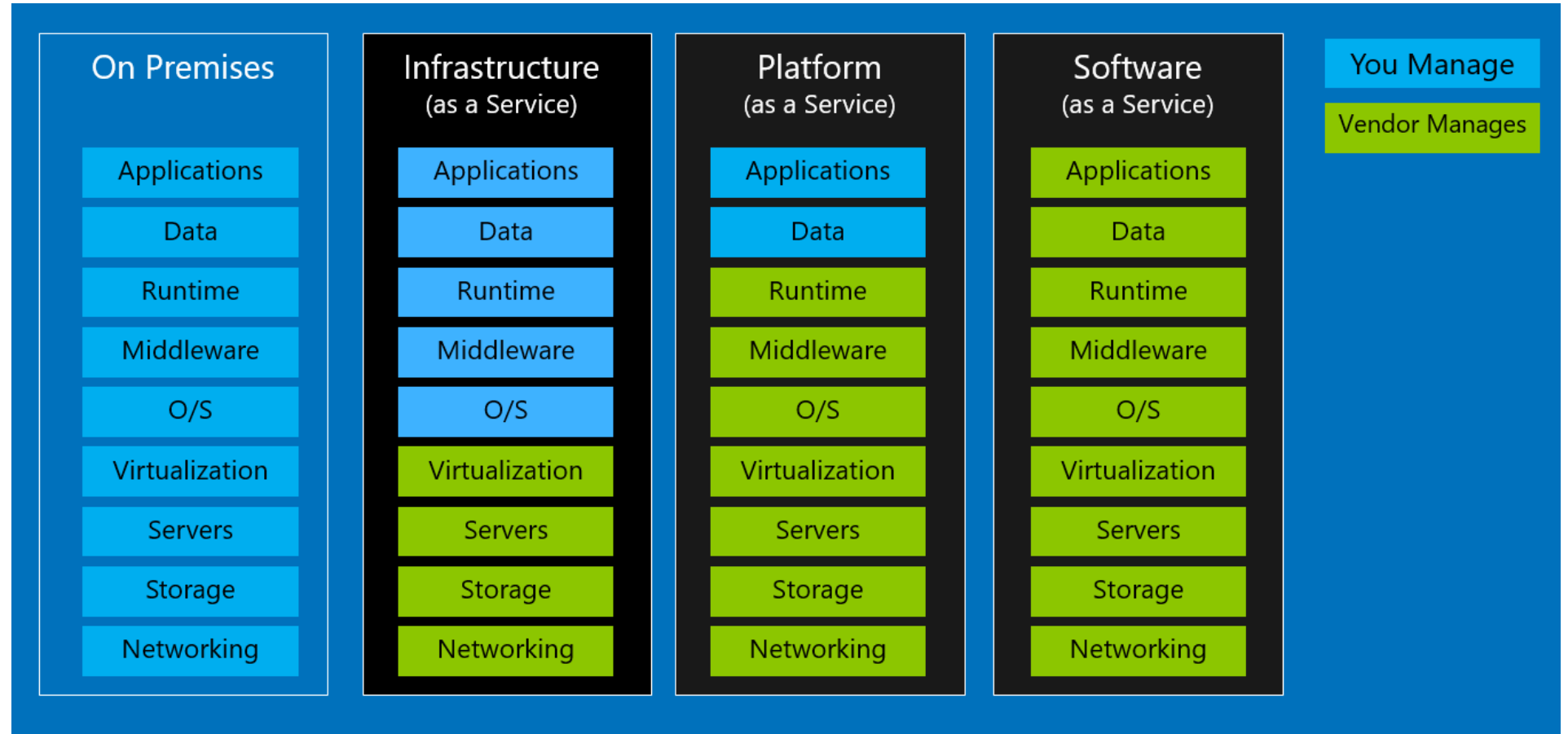
HPC SaaS

SPECIFICS

Karl Podesta (@karlpodesta)
kapodest@microsoft.com
<https://github.com/azurebigcompute>

Azure IaaS

Level Set: Cloud Basics



Level Set: Azure Basics

EA – Accounts – Subscriptions – Resource Groups

Compute – VMs also called Instances

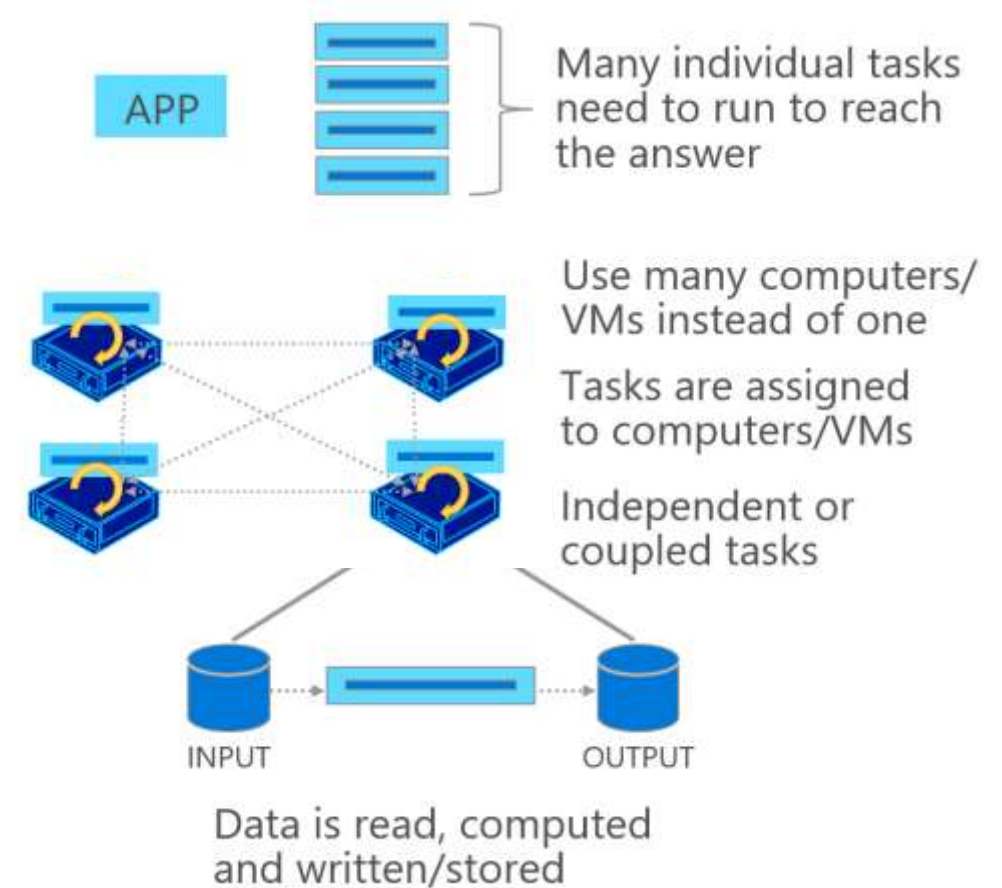
Network – VNets, Network Security Groups (NSGs)

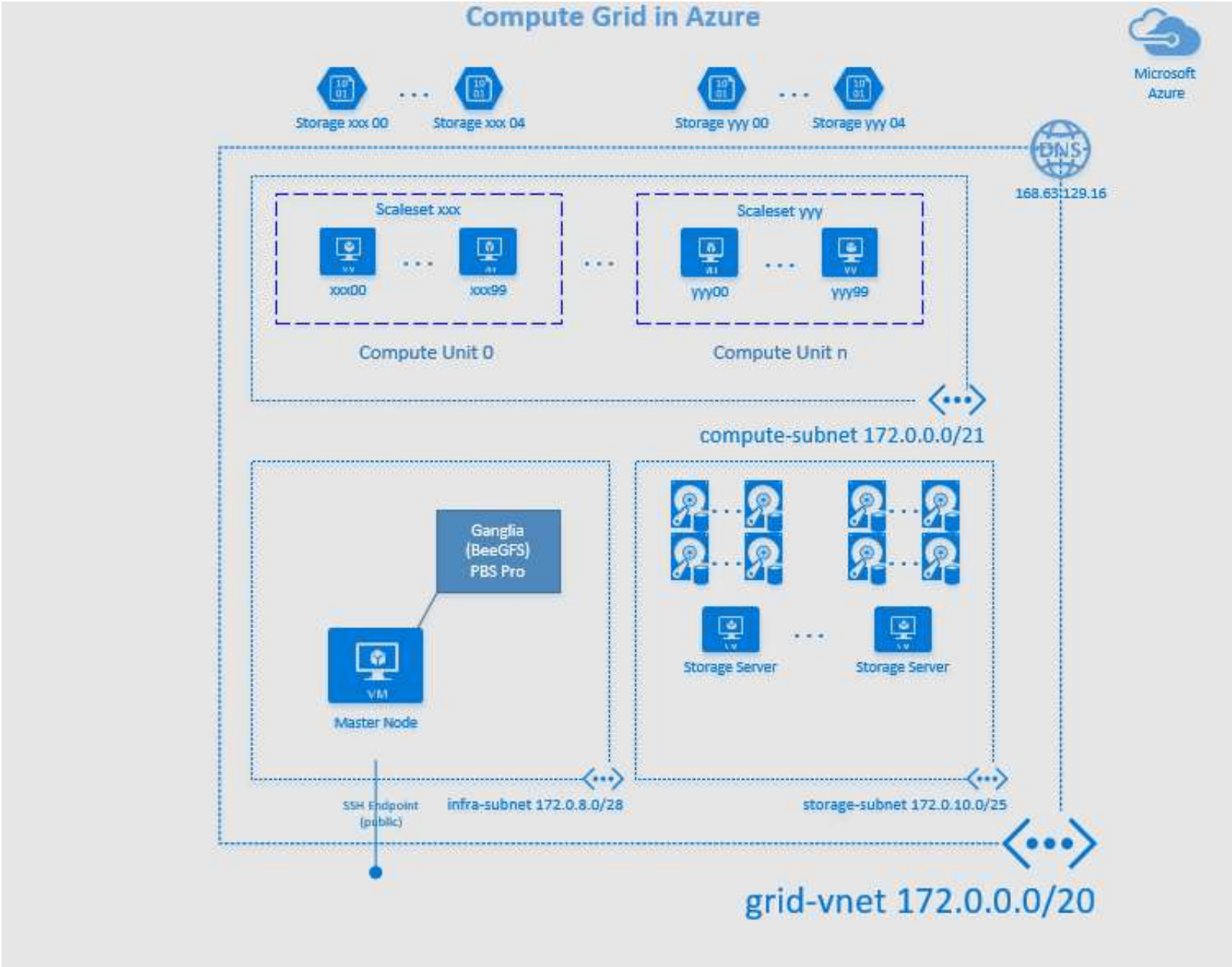
Storage – Blobs, Files, Disks

Permissions

Level Set: HPC Basics

- HPC Clusters
 - Head node
 - Compute nodes
 - Login nodes
 - Visualisation nodes
 - Storage nodes
 - Networking
- Jobs
- Queues
- Licenses





Logging in & looking around:

Connecting to Azure:

```
az login
```

Choosing to work inside a chosen subscription:

```
az account list
```

```
az account set -s <subscription id here>
```

Listing VM images:

```
az vm image list --publisher OpenLogic --all | grep HPC
```

```
az vm image list --publisher OpenLogic --all | grep CentOS
```

https://github.com/azurebigcompute/BigComputeLabs/tree/master/Azure_IaaS

My first VM

Making a Resource Group:

```
az group create -n hpclab -l westeurope -o table
```

Making a VM:

```
az vm create --name golden01 --resource-group hpclab --image  
OpenLogic:CentOS:7.4:7.4.20180118 --size Standard_A4 --storage-  
sku Standard_LRS --generate-ssh-keys -o table
```

(or)

```
az vm create --name golden02 --resource-group hpclab --image  
OpenLogic:CentOS-HPC:7.1:7.1.20170608 --size Standard_H16r --  
storage-sku Standard_LRS --generate-ssh-keys -o table
```

Showing a VM:

```
az vm list-ip-addresses -o table
```

https://github.com/azurebigcompute/BigComputeLabs/tree/master/Azure_IaaS

My first VM Scale Set (VMSS)

Making a scale set:

```
az vmss create -name lab-vmss --resource-group hpclab --image gold01-  
image --vm-sku Standard_H16r --storage-sku Standard_LRS --instance-  
count 2 --generate-ssh-keys --disable-overprovision
```

Showing a scale set:

```
az vmss list-instance-connection-info --name lab-vmss --resource-group  
hpclab
```

Growing/Shrinking:

```
az vmss scale --new-capacity 4 --name lab-vmss --resource-group hpclab  
-o table
```

https://github.com/azurebigcompute/BigComputeLabs/tree/master/Azure_IaaS

Testing Infiniband (RDMA/MPI)

Set your environment:

```
export INTELMPI_ROOT=/opt/intel/impi/2017.2.174
export I_MPI_FABRICS=shm:dapl
export I_MPI_DAPL_PROVIDER=ofa-v2-ib0
export I_MPI_ROOT=/opt/intel/compilers_and_libraries_2017.2.174/linux/mpi
source /opt/intel/impi/2017.2.174/bin64/mpivars.sh
```

Run a “ping-pong” test:

```
mpirun IMB-MPI1 pingpong
```

https://github.com/azurebigcompute/BigComputeLabs/tree/master/Azure_IaaS

Cleaning up... (deleting)

Deleting a VM:

```
az vm delete --name golden01 --resource-group hpclab -o table  
az vm list-ip-addresses -o table
```

Deleting a VM Scale Set:

```
az vmss delete --name lab-vmss --resource-group hpclab -o table
```

Deleting a Resource Group:

```
az group delete --name lab-vmss
```

https://github.com/azurebigcompute/BigComputeLabs/tree/master/Azure_IaaS

Something a bit more packaged?

Try the HPC Lab from our friends at Microsoft Research:

- Create a SLURM cluster using an Azure Resource Manager template
- Copy local resources to a SLURM cluster
- Remote into a SLURM cluster
- Run jobs on a SLURM cluster
- Start and stop nodes in a SLURM cluster
- Use the Azure Resource Manager to delete a SLURM cluster

<https://github.com/MSRConnections/Azure-training-course/tree/master/Content>

<https://github.com/MSRConnections/Azure-training-course/blob/master/Content/High-Performance%20Computing/SLURM%20Linux%20Cluster%20HOL.md>

Cloud Workshops 2018
HPC – Big Compute

INTRODUCTION

FUNDAMENTALS

Azure IaaS

HPC IaaS

HPC PaaS

HPC SaaS

SPECIFICS

Karl Podesta (@karlpodesta)
kapodest@microsoft.com
<https://github.com/azurebigcompute>

HPC IaaS

CycleCloud – a HPC cluster for every workload

INTRODUCTION

FUNDAMENTALS

Azure IaaS

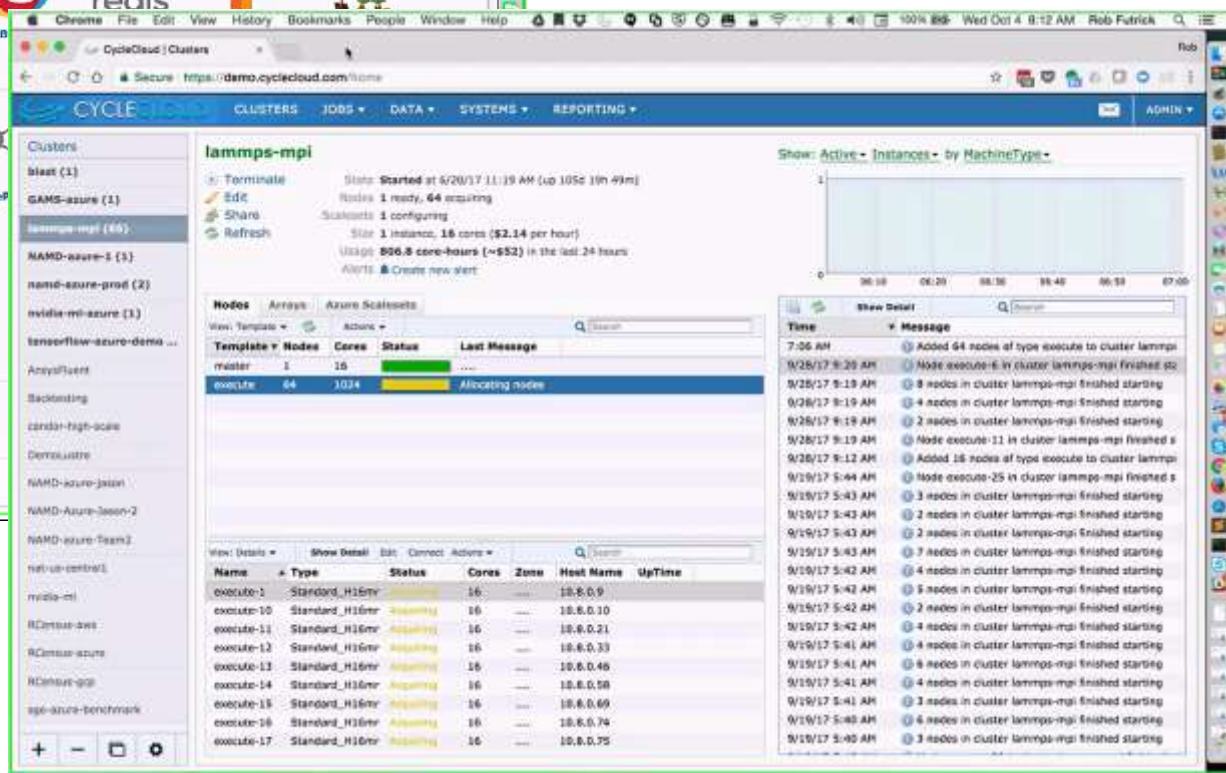
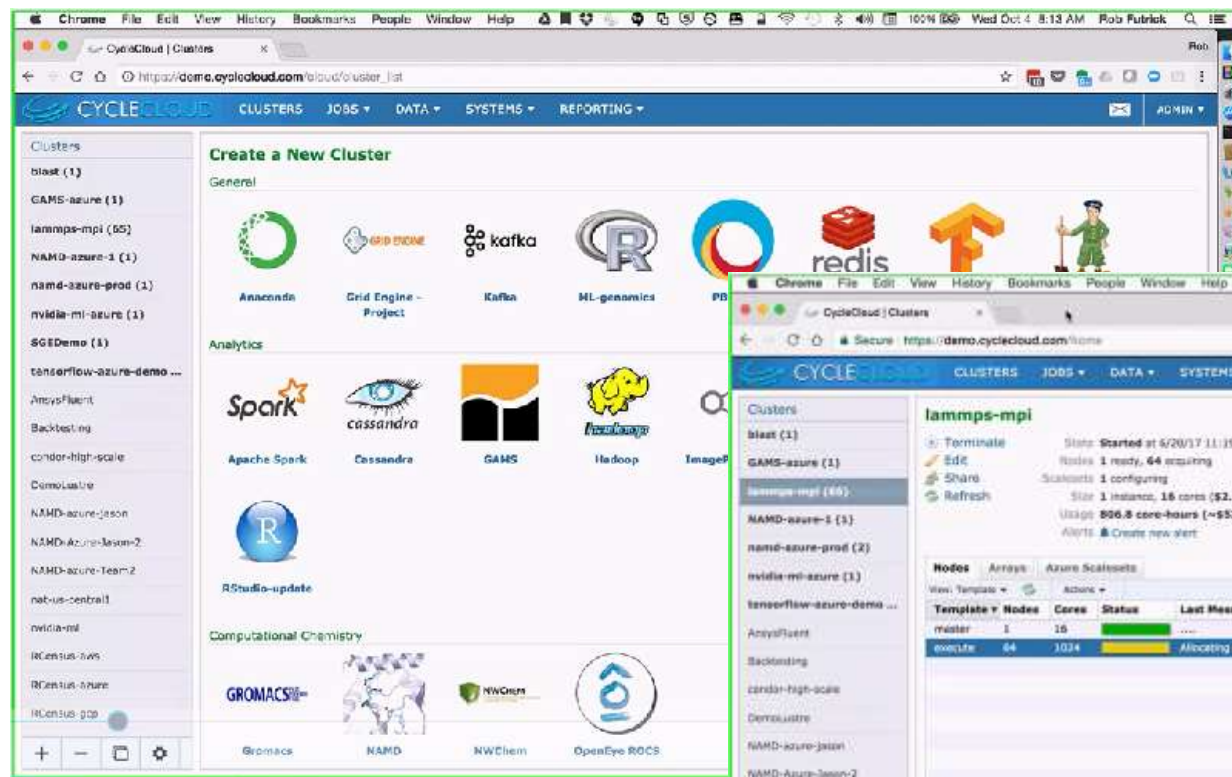
HPC IaaS

HPC PaaS

HPC SaaS

SPECIFICS

Karl Podesta (@karlpodesta)
kapodest@microsoft.com
<https://github.com/azurebigcompute>



HPC Pack – yes, you can do HPC with Windows!

INTRODUCTION

FUNDAMENTALS

Azure IaaS

HPC IaaS

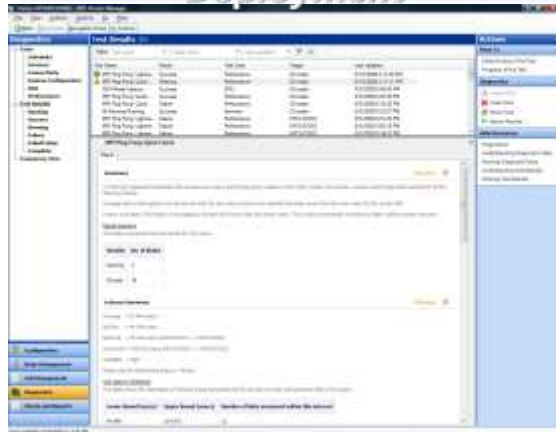
HPC PaaS

HPC SaaS

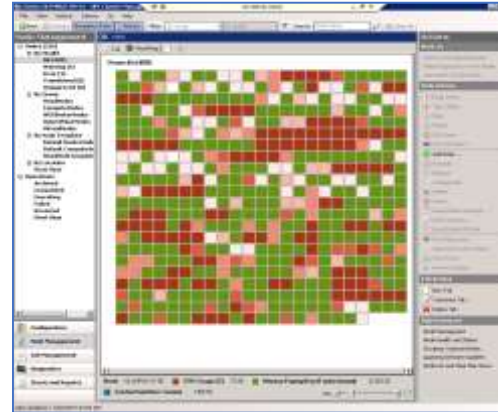
SPECIFICS

Karl Podesta (@karlpodesta)
kapodest@microsoft.com
<https://github.com/azurebigcompute>

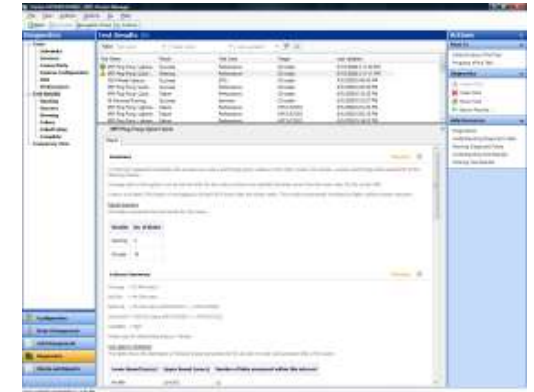
Configuration & Deployment



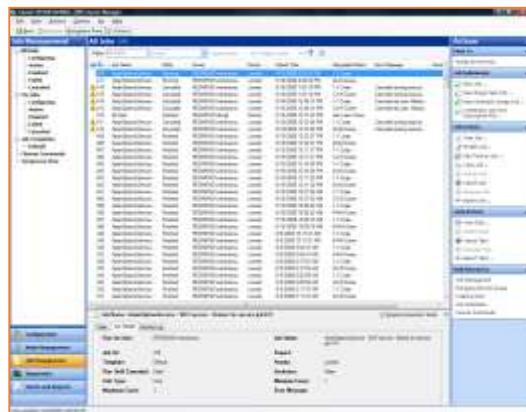
Monitoring



Node Management



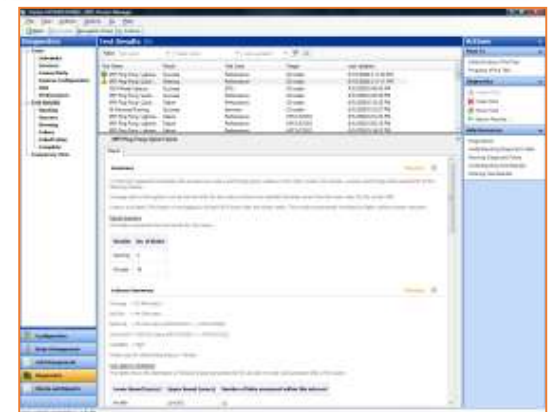
Job Management



Reporting



Diagnostics



Cloud Workshops 2018
HPC – Big Compute

INTRODUCTION

FUNDAMENTALS

Azure IaaS

HPC IaaS

HPC PaaS

HPC SaaS

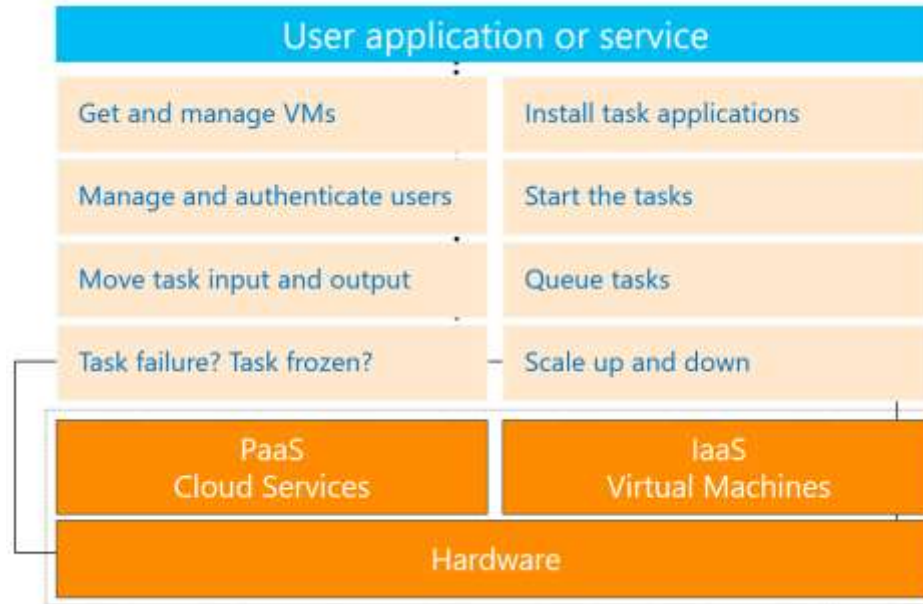
SPECIFICS

Karl Podesta (@karlpodesta)
kapodest@microsoft.com
<https://github.com/azurebigcompute>

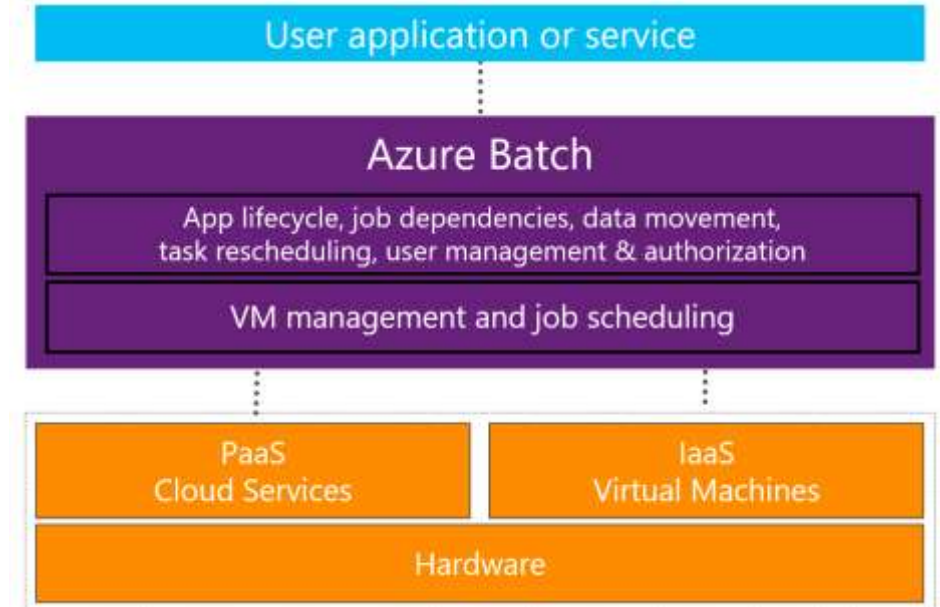
HPC PaaS

Azure Batch – Concepts

Before....



After...

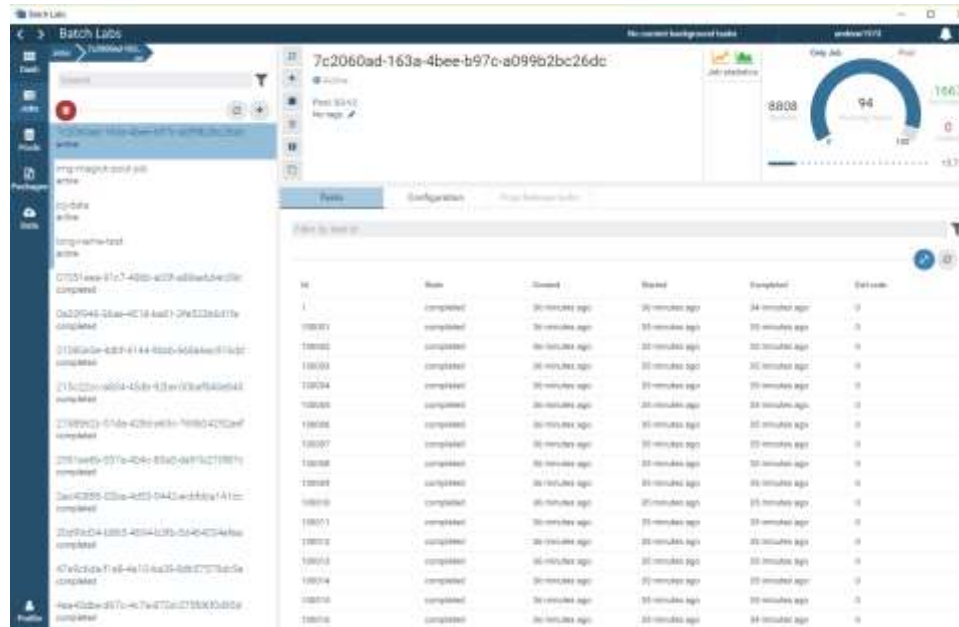


- Code directly against this service (it's an API, and it's free)
- Let Azure Batch manage the resources & scheduling
- Use any resources (any VM instance, GPUs, RDMA/MPI, etc)
- Popular with developers, software vendors (ISVs)
- Create "**Pools**", submit "**Jobs**" made up of "**Tasks**"
- Mix & match, dynamically resize, include Low Pri VMs to save!

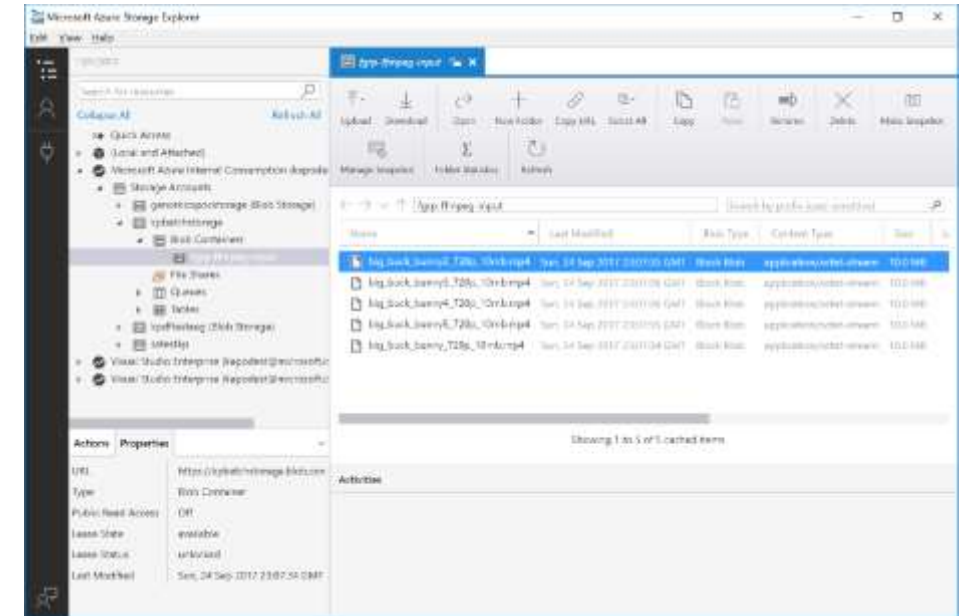


Azure Batch – Lab setup

Azure Batch Labs



Azure Storage Explorer



Batch AI Lab:

<https://github.com/azurebigcompute/CloudWorkshops/blob/master/BatchAIWorkshop.md>

Batch with FFMPEG Lab:

<https://github.com/azurebigcompute/Labs/tree/master/Azure%20Batch%20Masterclass%20Labs>

Cloud Workshops 2018
HPC – Big Compute

INTRODUCTION

FUNDAMENTALS

Azure IaaS

HPC IaaS

HPC PaaS

HPC SaaS

SPECIFICS

Karl Podesta (@karlpodesta)
kapodest@microsoft.com
<https://github.com/azurebigcompute>

HPC SaaS

HPC SaaS solutions from our partners (a few examples)

UberCloud – Click & Go from Marketplace



Rescale – submit input, scale, get output



Altair – pbscloud.io & solidThinking Unlimited



Oil & Gas: Schlumberger, Landmark, Paradigm

Schlumberger

Specifics

- Lab Choices
- Challenges
- Guidance
- Resources



You have a choice of Labs!

- **Remote Visualisation** – run a remote Linux or Windows desktop on our GPUs
- **HPC Containers** – Singularity, Docker, Azure Batch Shipyard
- **HPC Storage** – deploy a BeeGFS shared storage system
- **HPC Data Transfer** – methods for transferring data to/from/inside Azure
- **HPC Pack** – expand your Excel workbook calculations to a cloud cluster!
- **Batch AI/Render** – dip into AI training or Video Rendering with Azure Batch
- **Industry Scenario** – Bio/Genomics
- **Infrastructure Tooling** – see how to use Chef, Puppet, Ansible, Salt, Chocolatey
- **Solution/Architecture/Design Lab** – consider alternative design scenarios

Challenges:

What about **cost**?

What about **scale**?

What about **data movement**?

What about **3rd party software licensing**?

What about **openness & transparency**?

What about **security, privacy, and trust**?

Challenges: What about cost?

Pricing of Azure:

- Reserved Instances (1yr & 3yr)
- Burstable Instances
- Low Priority Instances
- Pay as you go

Buying from Microsoft:

- Sign up with Credit Card
- Negotiate an EA
- Buy through a 3rd party or CSP

Cost insight

- Cloudyn, aka Azure Cost Management

Cost control

- Controls in Cycle Computing
- Controls in Azure

Challenges: What about scale?

SMALL

MEDIUM

LARGE

Considerations:

- Test, **Measure**, Plan
- Start small - then work upwards or outwards
- VM spin-up time, and overprovisioning
- VM placement & availability sets
- Azure limits – storage accounts, cores, defaults
- Really big? Tell us what's going on

Challenges: What about data movement?

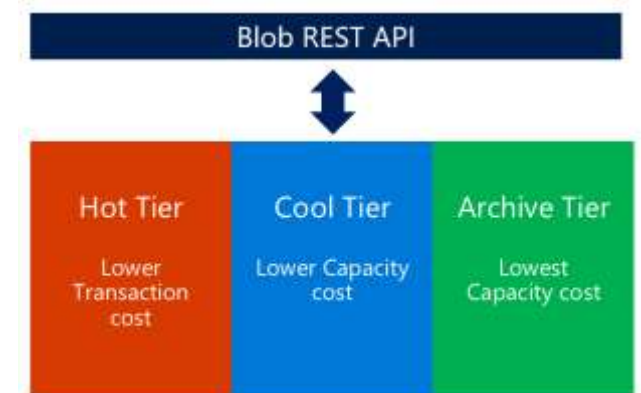
Getting data in or out:

- Standard Internet Connection
- VPN
- ExpressRoute
- Azure Transfer Software
- 3rd Party Transfer Software
- Azure Data Box



Moving data around:

- Between storage
 - disk <-> share <-> blob <-> archive
- Between regions



Challenges: What about software licenses?

- With software vendors: it varies! They are transforming, like all of us
- Don't underestimate your power as a customer
- Connecting to on-premise license servers via VPN
- Making license servers in the cloud
- Software/License Tokens
- Pay up front, or pay as you go

Challenges: What about skills?

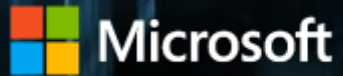
- Documentation: good and getting better
- Online courses from Microsoft
- Online courses from others
- Solutions on GitHub
- Keeping up – twitter, stackoverflow

Guidance – let's share some experiences 😊

- Using IaaS, PaaS, SaaS, or a combination?
- Choose one app, one user, or one scenario – try it and see
- Identify existing pain points, problems, potentials
- “Cloud thinking” – designing for change
- Azure Architecture/Solution Centre – designing for Azure
- When to: HPC Pack, CycleCloud, Azure Batch, ARM, Terraform, etc.
- Skilling up
- Keeping up

Resources

- Azure Big Compute – GitHub Repository
 - <https://github.com/azurebigcompute>
- Azure Documentation
 - <https://docs.microsoft.com/en-us/azure/>
- Videos online
- Contact us!



THANK YOU!

Your feedback is very welcome &
important to help us improve this
workshop for others

Go forth & compute!