Azure

Infrastructure as a Service

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Momentum

120,000
New Azure customer subscriptions/month

100 Trillion
Objects in Azure Storage

>85%
of Fortune 500 use Microsoft Cloud

1 in 3
Virtual Machines run Linux

Connectivity
ExpressRoute Partners on every continent except Antarctica!

Azure Hardware and VM Sizes

A

Entry Level VMs

E.g. Dev/Test Workload

D

General Purpose VMs

Common Applications,
Web servers etc

F

Compute Optimized VMs

Gaming, Analytics

G

Large Memory VMs

Large Databases

H

High Performance VMs

Fluid dynamics, monte
carlo simulations
Optional RDMA /
Infiniband network

L

Storage optimized VMs

No SQL Databases
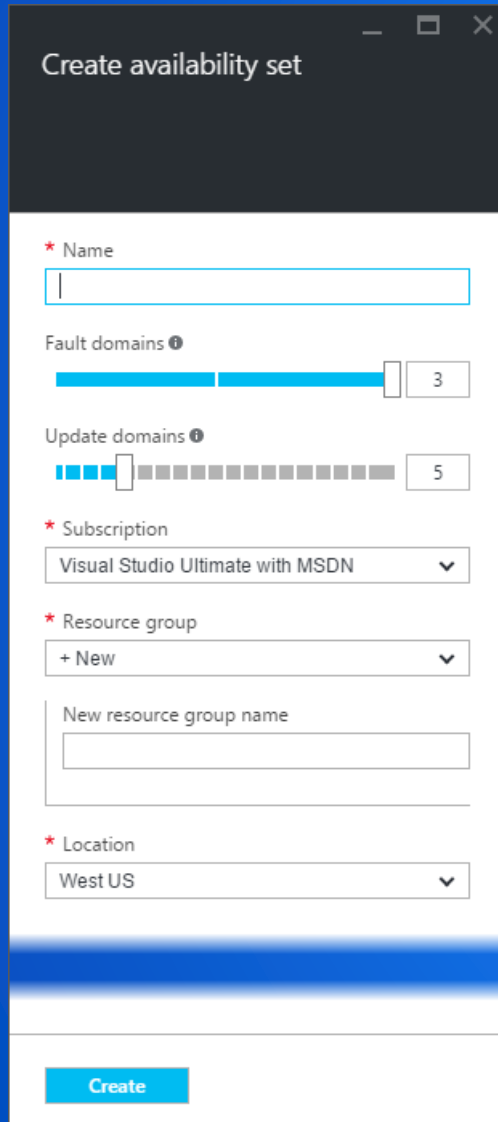(Cassandra, MongoDB),
Data warehousing

N

GPU-enabled VMs

Graphic based applications,
remote visualization
Optional RDMA / Infiniband network

- Large selection of VM sizes
- Different prices and price / performance
- Best price/perf mainly used for parallel workloads; e.g. Dv2, F
- Specialized hardware used for specific workloads and HPC apps

Availability Set


- **Fault domains** - fault domains define the group of virtual machines that share a common power source and network switch. By default, the VMs are separated across up to three fault domains and can be changed to between 1 and 3.
- **Update domains** - five update domains are assigned by default and this can be set to between 1 and 20. Update domains indicate groups of virtual machines and underlying physical hardware that can be rebooted at the same time.

VM Extensions

Extending the power of your VM.
Enable easier management.
Support partner ecosystem.
Full control remains with you!

IaaS extended

Agent

Symantec

CHEF
CODE CAN

Curated
extensions

Azure
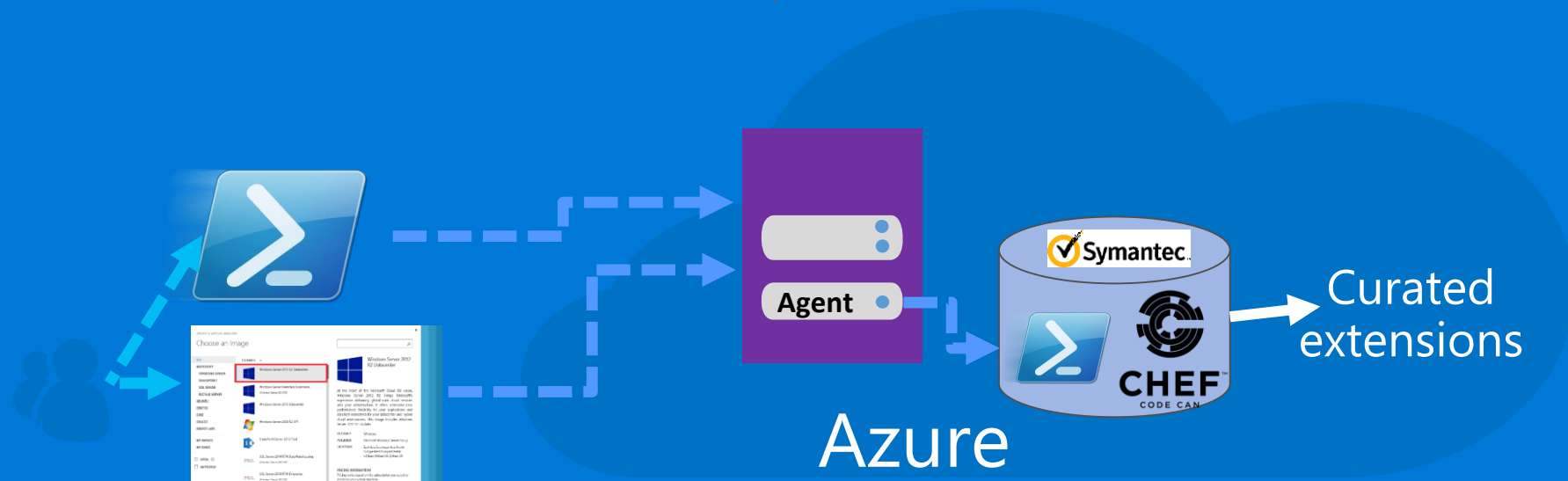
DevTest Labs

Controlled environment for Dev Teams with

- Base VM Images
- Formulas – Properties with which VMs are created
- Artifacts – Tools/Applications/Test Scripts to install/run after VM is created
- Policies – Automatically shutdown VMs based on a schedule
- Access Levels based on role

Virtual Machine Scale Sets

Deploy and manage VMs as a set

A scalable, platform-independent infrastructure for PaaS

Azure Container Service

Create, configure, and manage a cluster of virtual machines that are preconfigured to run containerized application.

Layer	Supported Technologies
Configuration as Code	ARM, Dockerfile, Docker Compose, Marathon.json
Host cluster management	VM Scale Sets
Container orchestration	Docker Swarm, Chronos, Marathon, Apache Mesos
Monitoring	OMS, App Insights

Technical Pre-requisites to a run HPC jobs

- **High performance A8, A9, H16r, H16mr VMs**
  - High performance, High bandwidth low latency VM's for tightly coupled workloads
  - High frequency VM's for high performance without low latency network (FDR InfiniBand)
- **Shared Storage – VM, BeeGFS, Lustre or NFS**
  - Parallel file system for global scratch or NFS share
- **Password-less SSH between the compute nodes**
  - SSH key shared across compute nodes for seamless communication
- **Vnet set up**
  - Recommended set up to controls IP range for connectivity to on-prem infrastructure
- **Scheduler**
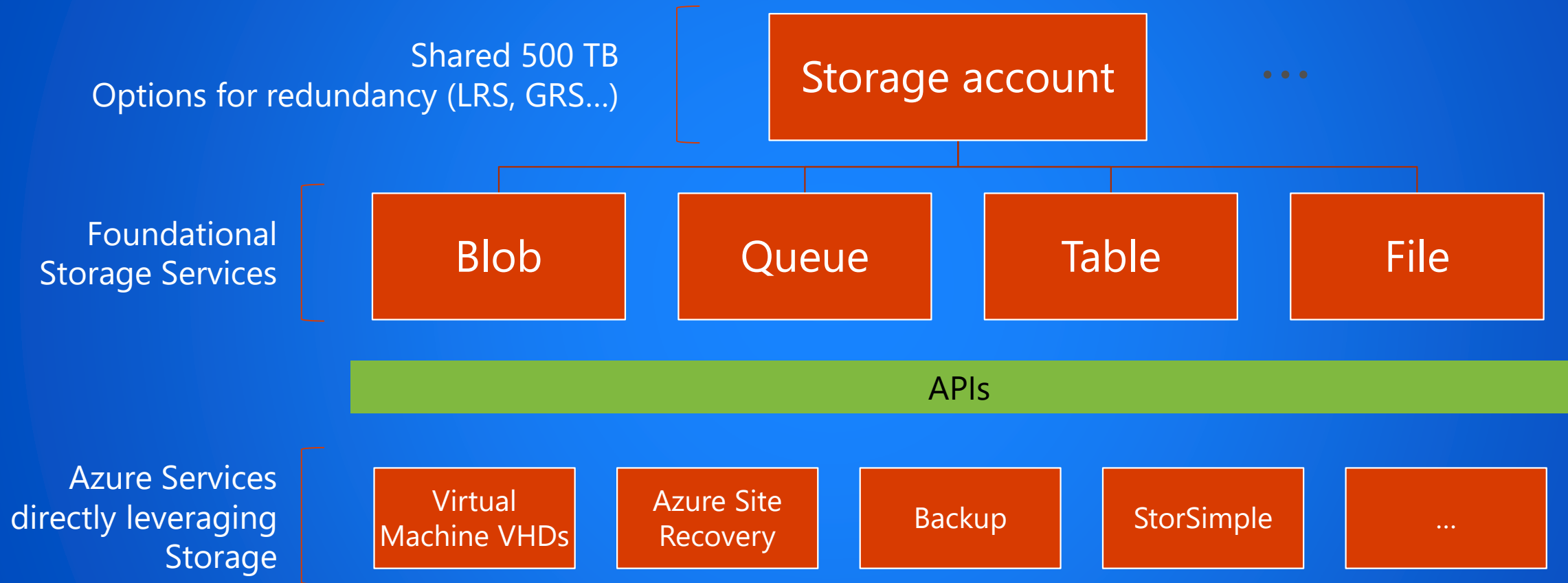 - Useful if more than one user going to access HPC service in the cloud

Azure Batch

Platform service providing easy job scheduling and cluster management, allowing applications or algorithms to run in parallel at scale

- ✓ Capacity on demand; jobs on demand
- ✓ Install and run the applications; new or existing applications
- ✓ Efficient - scale according to load; start work when first VM available; no head-node
- ✓ Pay for use - by the minute
- ✓ Scale - 1 to 10,000's VMs for a cluster; 1 to millions of tasks
- ✓ Choice – Use any VM according to job and application requirements; Windows or Linux
- ✓ No need to install or manage cluster software
- ✓ Cost effective – no charge for Batch, only pay for consumed resources

If a solution requires VMs and a queue to run apps, then Batch should be a great fit

What is Azure Storage

Shared 500 TB
Options for redundancy (LRS, GRS...)

Storage account

...

Foundational Storage Services

Blob **Queue** **Table** **File**

APIs

Azure Services directly leveraging Storage

| Virtual Machine VHDs | Azure Site Recovery | Backup | StorSimple | ... |

Azure Storage Platform Capabilities

Scalability

Per account: 500TB of data , 20000 tps, 10Gbps ingress/20Gbps egress

Durability Options

Locally Redundant (LRS), Zone Redundant (ZRS), Geo-Redundant (GRS)

Read access from geo-secondary (RA-GRS)

Availability

99.9% for reads/writes, 99.99% for reads with RA-GRS. Backed by SLA.
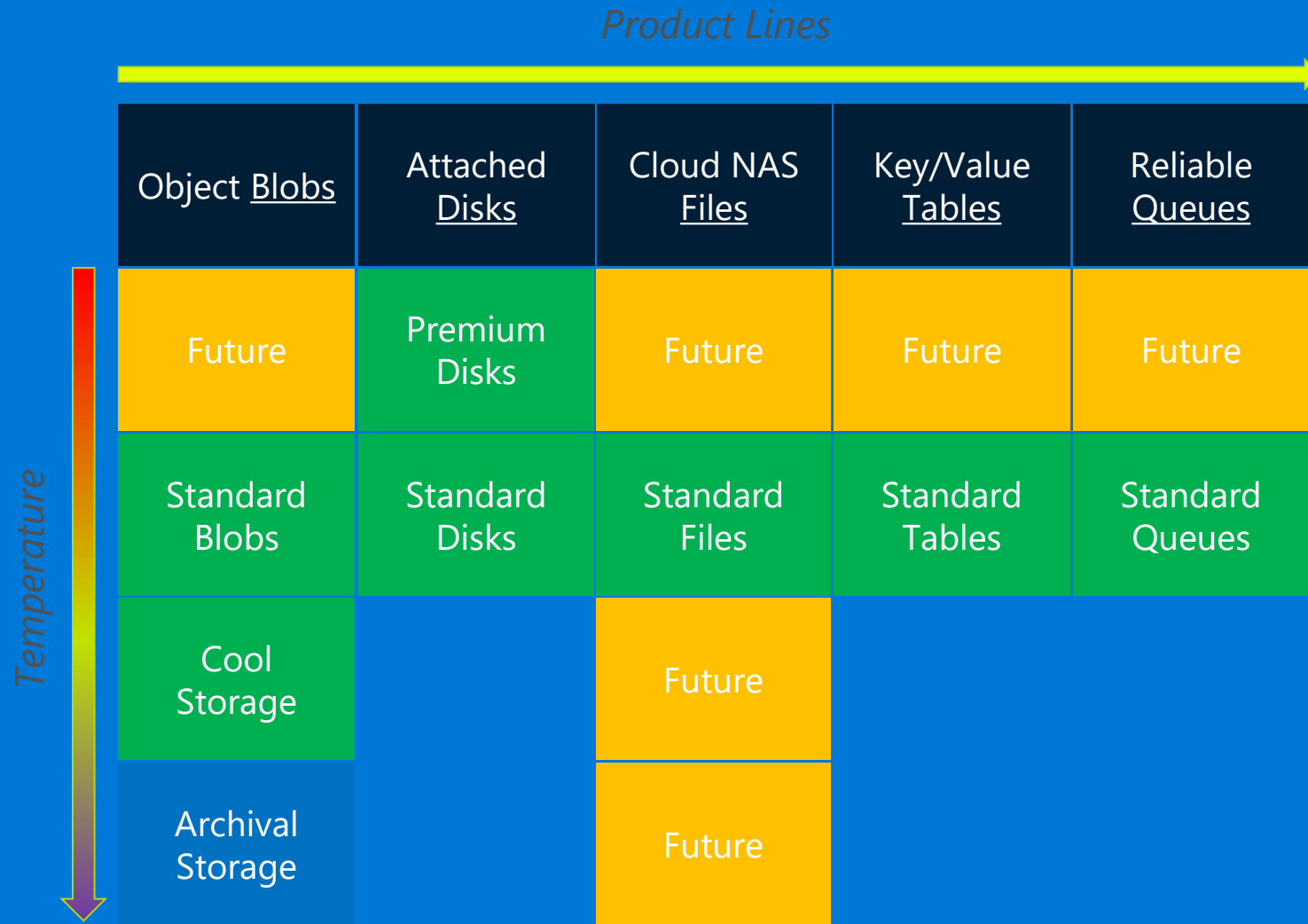
Security

Symmetric shared key (AuthN)

Public (blob service only)

Azure Storage Service Encryption (SSE) for Data at Rest helps you protect and safeguard your data to meet your organizational security and compliance commitments.

Analytics

Rich perf-counter like metrics and detailed logs

Hierarchical/Tiered Cloud Storage

Product Lines

Temperature

Object Blobs	Attached Disks	Cloud NAS Files	Key/Value Tables	Reliable Queues
Future	Premium Disks	Future	Future	Future
Standard Blobs	Standard Disks	Standard Files	Standard Tables	Standard Queues
Cool Storage		Future		
Archival Storage		Future		

Services offered at different temperatures to match workload

Vision: Automatic data tiering based on customer defined policies

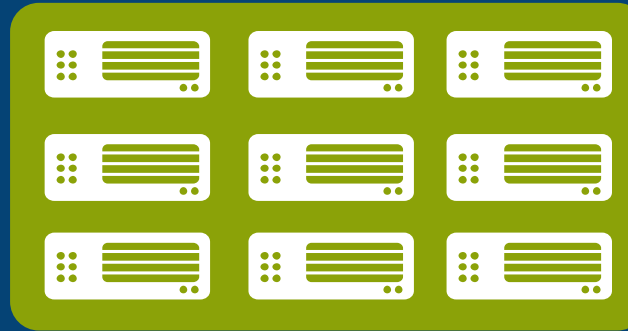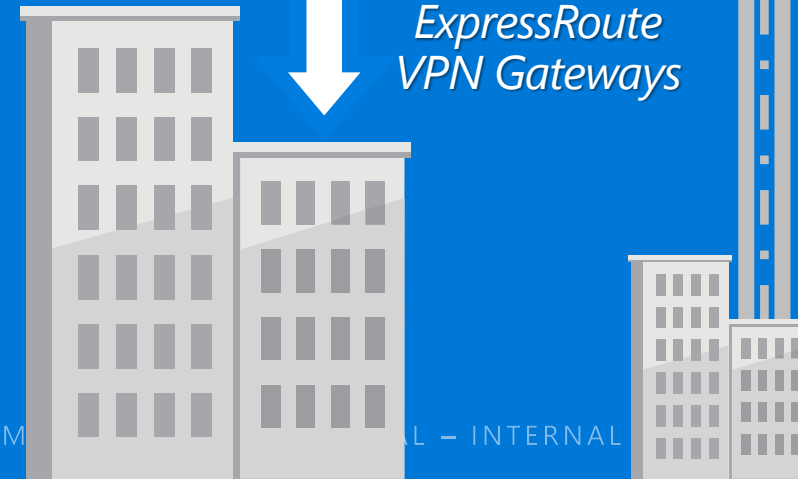# The Big (Network) Picture

Users
Internet

Azure
Virtual Network

Virtual Network

"Bring Your Own Network"

Segment with subnets and
Network Security Groups

Control traffic flow with User
Defined Routes

Front-End Access

Dynamic/Reserved Public IP addresses

Direct VM access, ACLs for security

Load balancing

DNS services: hosting, traffic
management

DDoS protection
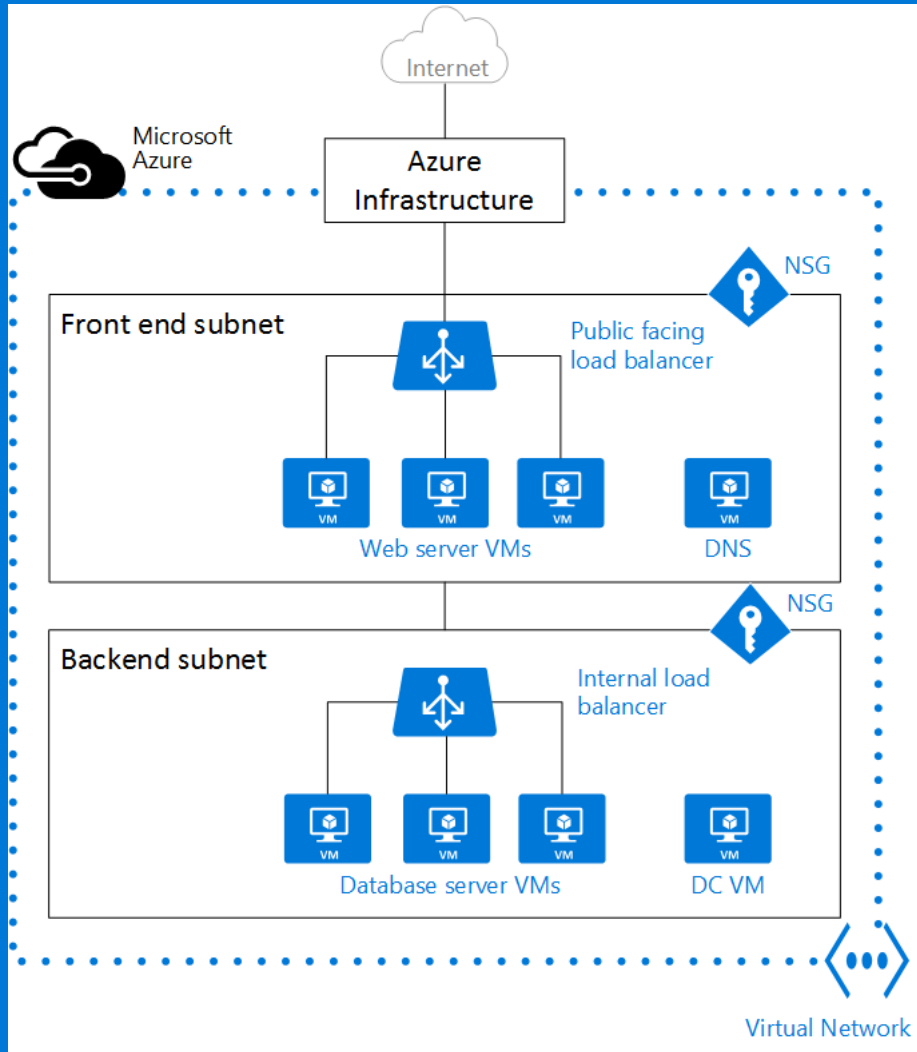
Backend
Connectivity

*ExpressRoute
VPN Gateways*

Backend Connectivity

Point-to-site for dev / test

VPN Gateways for secure
site-to-site connectivity

ExpressRoute for private
enterprise grade connectivity

Azure Virtual Network (VNet)

- An Azure virtual network (VNet) is a representation of your own network in the cloud. It is a logical isolation of the Azure cloud dedicated to your subscription. You can fully control the IP address blocks, DNS settings, security policies, and route tables within this network.
- Cannot have overlapping IP ranges on-prem / Azure / other cloud providers. Leave Room for Future Growth – can always **add** Subnets and VNETs

Network Security Options

- Network security group (NSG) contains a list of Access Control List (ACL) rules that allow or deny network traffic to your VM instances in a Virtual Network. Sample NSG Rules -
  - No access from the front end or back end to the Internet.
  - Access to port 3389 to any web server in the front end, for traffic coming from the front end subnet itself.
  - Access to port 3389, 1433 to all SQL Server VMs in the back end from the front end subnet only.
  - Separation of management traffic (port 3389) and DB traffic (1433) on different NICs in the back end VMs.

- A virtual appliance is just another VM in your VNet that runs a software based appliance function, such as firewall, WAN optimization, or intrusion detection. You can create a route in Azure to route your VNet traffic through a virtual appliance to use its capabilities. NSGs provide layer 4 Access Control List (ACL) to incoming and outgoing packets. If you want to use a layer 7 security model, you can use a firewall appliance.
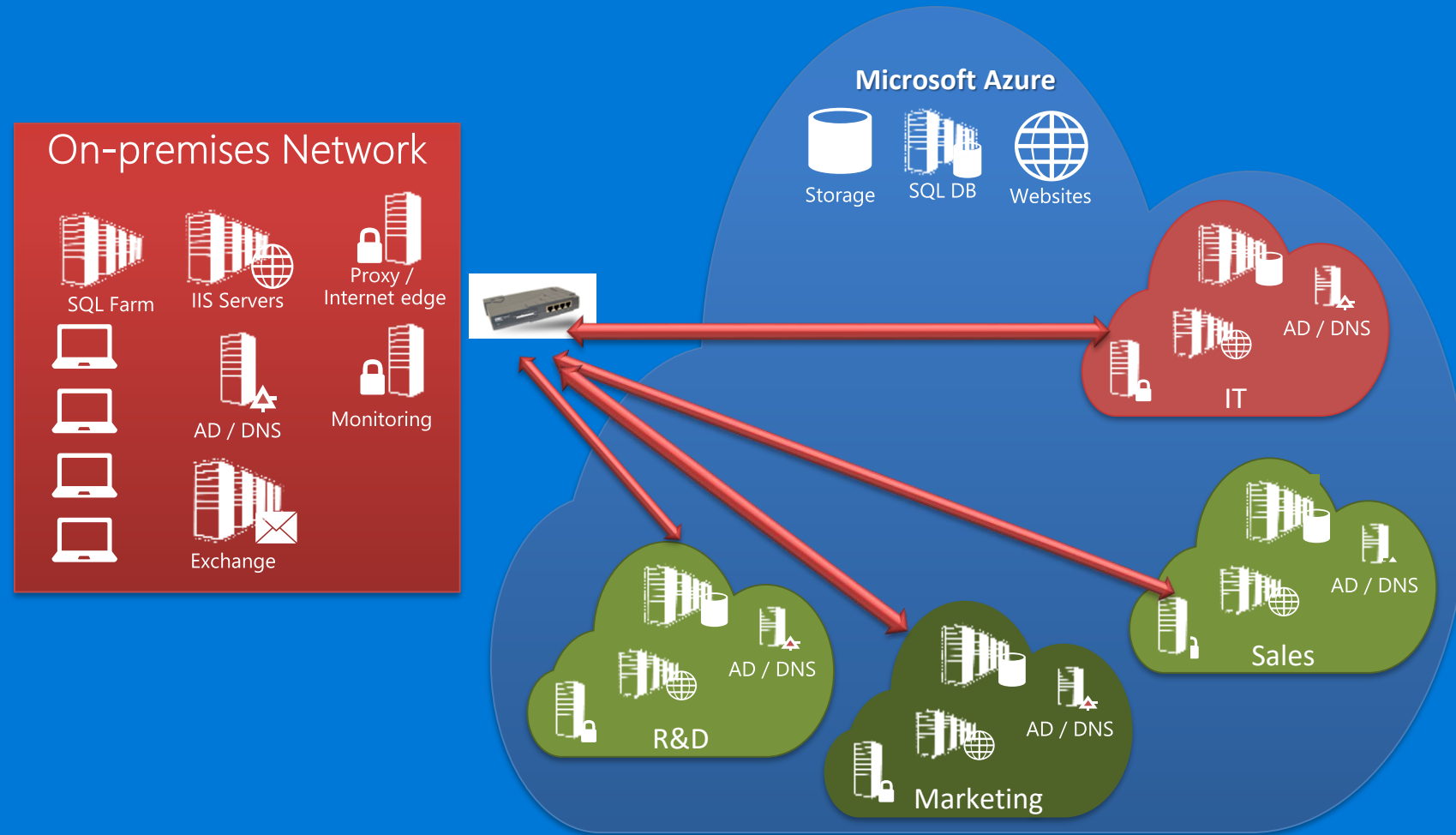
Load Balancer Hierarchy

| Azure Service	What	Example
Traffic Manager	Cross-region redirection & availability	http://news.com ➔ apac.news.com ➔ emea.news.com ➔ us.news.com
Azure Load Balancer	In-region scalability & availability	emea.news.com ➔ AppGw1 ➔ AppGw2 ➔ AppGw2
Azure Application Gateway	URL/content-based routing & load balancing	news.com/topnews news.com/sports news.com/images
VMs	Web Servers	
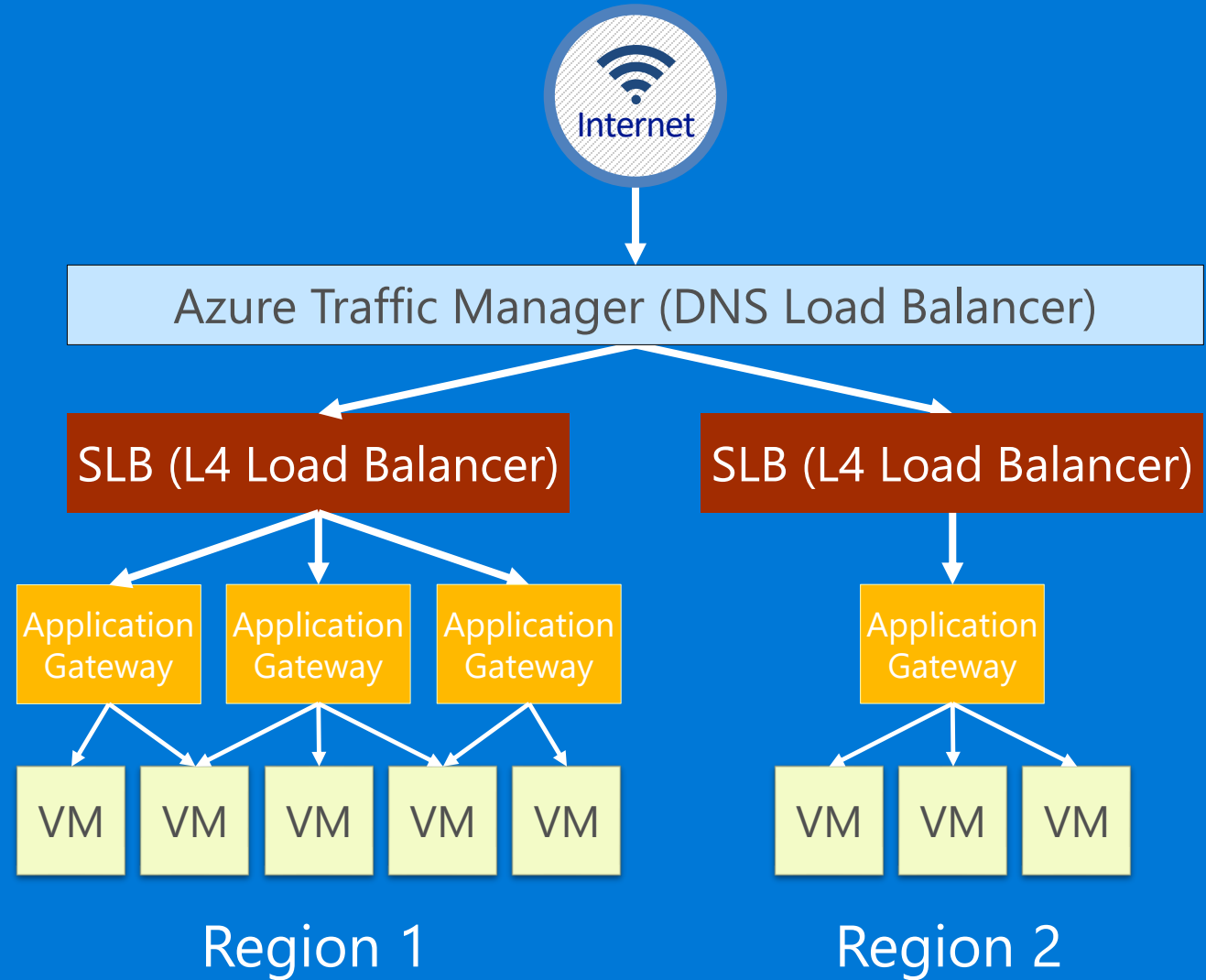
Site-to-Site VPN Connections

- IPsec VPN over Internet
- Each <u>VNet</u> requires S-S VPN to connect to on-premises
- Each VNet uses a GatewaySubnet

Microsoft Azure

Storage   SQL DB   Websites

On-premises Network

SQL Farm   IIS Servers   Proxy / Internet edge

AD / DNS   Monitoring

Exchange

IT

AD / DNS

R&D

AD / DNS

Marketing

AD / DNS

Sales

AD / DNS

ExpressRoute Connections

- Private connections between Azure datacenters and infrastructure on your premises or in a colocation environment. Provides lower latency, higher bandwidth and greater availability.
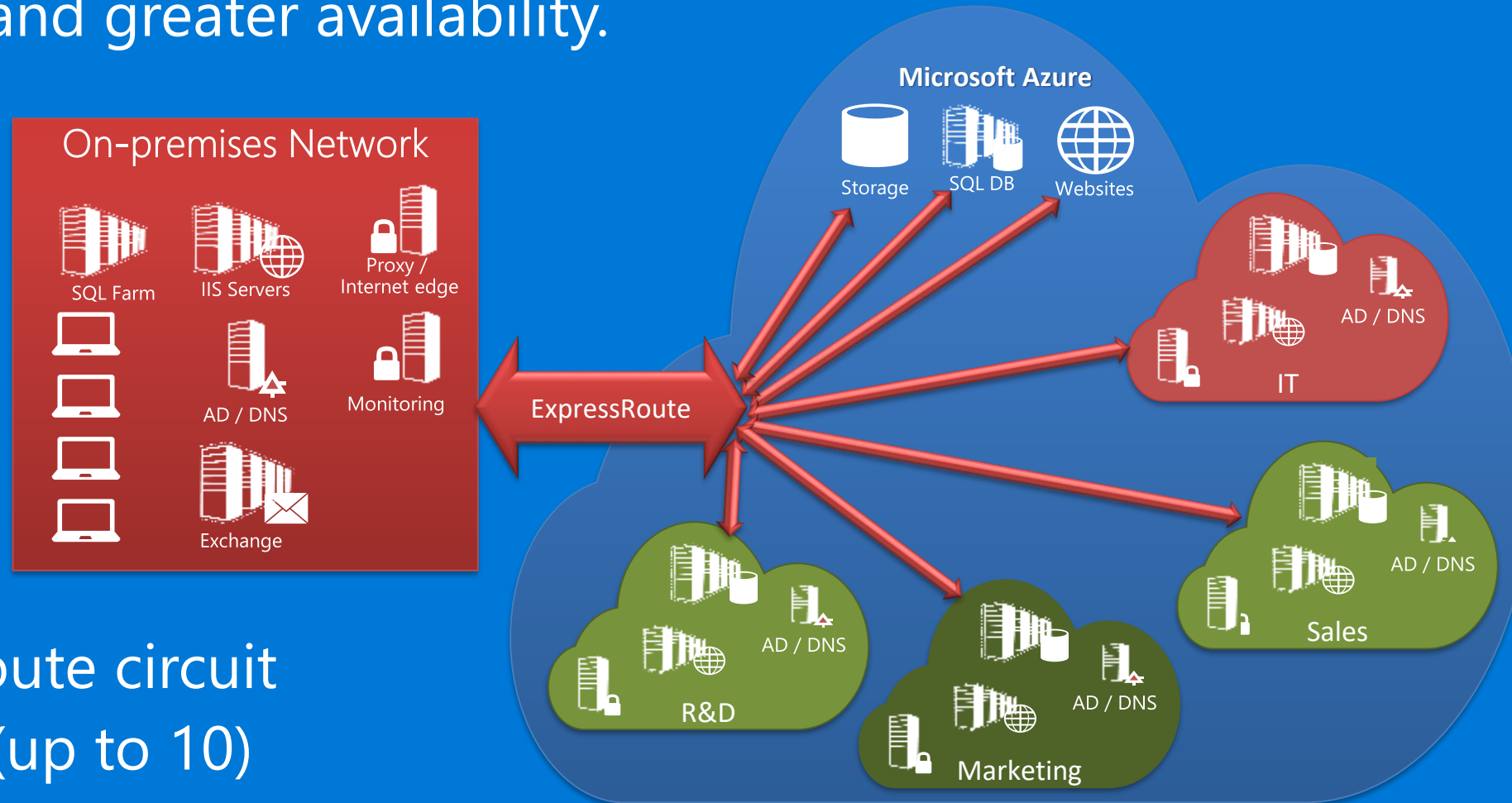
- Share an ExpressRoute circuit across subscriptions (up to 10)

VPN Gateway Options

Azure VPN Gateway

- Fault-tolerant Routing & remote access service. Basic, Standard, & High Performance SKU's

- 100-200Mbps throughput for VPN Gateway Type and 500-2000Mbps throughput for ExpressRoute Gateway Type

- Static (Policy-based, 1 Tunnel) or RouteBased (Dynamic routing, multiple tunnels) available

3rd Party Appliances

- Vendor-certified appliances acquired through Azure Marketplace (Cisco, Barracuda, Checkpoint, Juniper etc)

- Often provide features beyond IPSec VPN tunneling. Build to vendor's recommendations to support throughput/workloads

- Use UDRs & NSGs to force traffic through appliance(s) for analysis/control

Demo