Azure Introduction and Training

Part One

[Current to Sept 2017]

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Course Content

- The tools you need to work with Azure
- Azure design approach and how to match cost with design
- Fundamentals of:
  - Network, Storage, Compute
  - Advanced Networking:
  - DMZ, Security Groups, User Defined Routing, Load Balancers, Perimeter Devices
- Backup and Recovery Options
- Disaster Recovery to other regions
- Examples of Complex Environments
- Automation through Azure Resource Manager (ARM) Templates

About Gavin

- Freelance IT Consultant.
- 22 years in industry.
- 8 years in Microsoft Ireland - Datacentre SSP.
- Pluralsight author:
  - Designing a Hybrid Cloud in Azure
  - Creating a DMZ in Azure
  - Coming soon : Auditing Your Azure Assets for Security and Best Practices

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What do you want from this course?

Digital Transformation

A quick discussion … and some other random thoughts

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"Digitalization is the use of digital technologies to **change a business model** and provide **new revenue** and value-producing opportunities; it is the process of moving to a digital business."

- Gartner IT Glossary

Moving to “the cloud” is not digital transformation. Hosting infrastructure in Azure will not make your customers digitally transformed…

… but **infrastructure** is the **backbone of business** operations. It has to be capable of **supporting** the changes to **business models**.

Cloud cannot be "cheaper" than on-premise. Subscription models are completely different to CAPEX. They are **managed and accounted in different ways.**

Price/Performance ratios between cloud vendors are very **similar**.

Detailed comparisons are possible. Azure and Google tend to be cheaper than AWS. It is very easy to skew the results in favour of one platform or the other.

Service Level Agreements

Make sure you know what you are getting into.

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Service Level Agreements

- Important to be clear about EVERY Service Level Agreement (SLA) for services you use in Azure
- SLA's are financially backed. They do not offer loss of revenue return. Just a percentage of the charge for the service usage (called an SLA credit)
- Microsoft's service SLAs are very particular and they do change
- The sum of the services used to build the Azure environment will determine the SLA e.g. Compute, storage, network, etc.

Service Level Agreements

Virtual Machine SLA :

- 99.9% for single VM (but only with Premium Storage)
- 99.95% for 2 or more VMs in an Availability Group
- Cost is a balancing act here: e.g. a single Domain Controllers on Premium Storage or two Domain Controllers on Standard storage in an availability set.
- https://azure.microsoft.com/en-us/support/legal/sla/virtual-machines/v1_4/

Service Level Agreements

Storage SLA :

- 99.9% for (Read and Write) on Redundant Storage (LRS), Zone Redundant Storage (ZRS), and Geo Redundant Storage (GRS) Accounts.
- 99.99% for **READ** Access-Geo Redundant Storage (RA-GRS) on the READ if you retry in the secondary site. Its 99.9% on the **WRITE** to RA-GRS.
- No SLA on the time for the asynchronous write
- https://azure.microsoft.com/en-us/support/legal/sla/backup/v1_0/
- Backup (Recovery Service Vaults) have a 99.9% SLA for the availability of the service.

Service Level Agreements

Site Recovery SLA :

- "For each Protected Instance configured for On-Premises-to-On-Premises Failover, we guarantee at least 99.9% availability of the Site Recovery service.
- For each Protected Instance configured for On-Premises-to-Azure planned and unplanned Failover, we guarantee a four-hour Recovery Time Objective for unencrypted Protected Instances, and a six-hour Recovery Time Objective for encrypted Protected Instance, depending on the size of the Protected Instance."

-Quote from https://azure.microsoft.com/en-us/support/legal/sla/site-recovery/v1_0/

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Service Level Agreements

Site Recovery SLA :

"Monthly Recovery Time Objective and Service Levels for On-Premises-to-Azure Failover

- "Recovery Time Objective (RTO)" means the period of time beginning when Customer initiates a Failover of a Protected Instance experiencing either a planned or unplanned outage for On-Premises-to-Azure replication to the time when the Protected Instance is running as a virtual machine in Microsoft Azure, excluding any time associated with manual action or the execution of Customer scripts.
- "Monthly Recovery Time Objective" for a specific Protected Instance configured for On-Premises-to-Azure replication in a given billing month is four hours for an unencrypted Protected Instance and six hours for an encrypted Protected Instance. One hour will be added to the monthly Recovery Time Objective for each additional 25GB over the initial 100GB Protected Instance size."

What **impact** has cloud had on **Co-location services?**.

A significant number of people are NOT implementing co-location (mutli-datacentre) designs when they move to cloud hosting.

Service Level Agreements:

- Realistically you can only **position a 99.9% SLA**
- 99.9% is far above what most can (really and consistently) achieve with traditional hosting
- Cloud is having an impact on co-location requirements.
- Co-location comes into its own when you cannot achieve the RTO you need e.g. large VM and dataset restore

Designing Solutions in Azure

Look before you leap… design before you build.

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Challenges

- The skills required for Azure design (any cloud platform) require more in-depth knowledge of networking, storage and security. It's a software defined datacentre.
- Every mistake can have a direct impact on cost to you.
- It is critical to have by-the-book supported configurations. Unsupported configurations will not end well.
- Designing before building is the only way to ensure quality design that meets all support and technical requirements
- The Azure Documentation from Microsoft is not great. Its getting better. But there is a hell of lot to get through. https://docs.microsoft.com/en-us/azure/guidance/ ← Only time will tell how up-to-date this is kept.

  "***This content is in active development. It is useful today, so we are making it available for preview. We value your feedback" – Quote from Microsoft***

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Azure designs are **complicated**. There are many **variables**. Make sure you **plan** everything out **before building**....

EXCEL will become your best friend:

Standard VMs						Standard Disks							
Servername	Description	VM Size	CPU	MEM	SQL VM	OS Storage GB	Data Storage GB	Data Disks	Storage Type	Cost Per Hour	Hours Per Mon	Compute Cost Per	Compute Cost Per Year
VPX #1	Netscaler Appliance (Linux)	Standard_A2	2	3.5	N	20			Standard	0.101	744	€75.14	€901.73
VPX #2	Netscaler Appliance (Linux)	Standard_A2	2	3.5	N	20			Standard	0.101	744	€75.14	€901.73
dc01	WS2012 R2 Domain Controller	Standard_A2_v2	2	3.5	N	127	100	1 x 100GB	Standard	0.110	744	€81.84	€982.08
dc02	WS2012 R2 Domain Controller	Standard_A2_v2	2	3.5	N	127	100	1 x 100GB	Standard	0.110	744	€81.84	€982.08
Broker#1	Citrix XenApp Delivery Controller	Standard_D2_v2	2	7	N	127			Standard	0.206	744	€153.26	€1,839.17
Broker#2	Citrix XenApp Delivery Controller	Standard_D2_v2	2	7	N	127			Standard	0.206	744	€153.26	€1,839.17
HotPin	HotPin Application Server	Standard_A1_V2	1	1.75	N	127			Standard	0.052	744	€38.69	€464.26
Syslog	Syslog	Standard_A1_V2	1	1.75	N	127			Standard	0.052	744	€38.69	€464.26
SFTP #1	SFTP inbound in DMZ	Standard_A1_V2	1	1.75	N	127			Standard	0.052	744	€38.69	€464.26
Manage #1	Management box	Standard_A2_v2	2	3.5	N	127			Standard	0.110	744	€81.84	€982.08
Monitor #1	Monitoring Gateway	Standard_A2M_V2	2	16	N	127			Standard	0.177	744	€131.69	€1,580.26
qualsys01	Qualsys Service	Standard_A1_v2	1	1.75	N	127			Standard	0.052	744	€38.69	€464.26
wsus01	Patch Management	Standard_A2_v2	2	3.5	N	127	1024	1 x 1024GB	Standard	0.110	744	€81.84	€982.08
Total			22			1437	1224					€1,070.62	€12,847.39

Premium VMs and Premium Storage						Premium SSD Disks with allocated VM (Maximums based on VM and Disk combination)							
Servername	Description	VM Size	CPU	MEM	SQL VM	OS Storage GB	Data Storage GB	Data Disks	Storage Type	Cost Per Hour	Hours Per Mon	Compute Cost Per	Compute Cost Per Year
sql01	SQL Node 1 - SQL Server 2014 Standard Edition	Standard_DS2_v2	2	7	Y	127	512	0 x P20 [2,300 IOPS/150MBps]	Premium	0.543	744	€403.99	€4,847.90
XenAppServer#1	Citrix XenApp Application Server	Standard_DS3_v2	4	14	N	127	512	1 x P20 [2,300 IOPS/150MBps]	Premium	0.412	744	€306.53	€3,678.34
XenAppServer#2	Citrix XenApp Application Server	Standard_DS3_v2	4	14	N	127	512	1 x P20 [2,300 IOPS/150MBps]	Premium	0.412	744	€306.53	€3,678.34
XenAppServer#3	Citrix XenApp Application Server	Standard_DS3_v2	4	14	N	127	512	1 x P20 [2,300 IOPS/150MBps]	Premium	0.412	744	€306.53	€3,678.34
XenAppServer#4	Citrix XenApp Application Server - Test/Dev	Standard_DS3_v2	4	14	N	127	512	1 x P20 [2,300 IOPS/150MBps]	Premium	0.412	744	€306.53	€3,678.34
App Server #1	App Server	Standard_DS2_v2	2	7	N	127	512	1 x P20 [2,300 IOPS/150MBps]	Premium	0.206	744	€153.26	€1,839.17
App Server #2	App Server	Standard_DS2_v2	2	7	N	127	512	1 x P20 [2,300 IOPS/150MBps]	Premium	0.206	744	€153.26	€1,839.17
App Server #3	App Server	Standard_DS2_v2	2	7	N	127	512	1 x P20 [2,300 IOPS/150MBps]	Premium	0.206	744	€153.26	€1,839.17
App Server #4	App Server	Standard_DS12_v2	4	28	N	127	512	1 x P20 [2,300 IOPS/150MBps]	Premium	0.490	744	€364.56	€4,374.72
fs01	WS2012R2 File Server	Standard_DS2_v2	2	7	N	127	512	1 x P20 [2,300 IOPS/150MBps]	Premium	0.490	744	€364.56	€4,374.72
fs02	WS2012R2 File Server	Standard_DS2_v2	2	7	N	127	512	1 x P20 [2,300 IOPS/150MBps]	Premium	0.490	744	€364.56	€4,374.72
Total			11			1397	5632					€3,183.58	€38,202.91

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Challenges

- The relationship between Compute and Storage
- The relationship between storage speeds (IOPS) and VM connectivity to storage (ThroughPut)
- Virtual Machine performance versus Cost
- The relationship between VM CPUs and the cost other software e.g. SQL
- Securing the perimeter in Azure
- Network Security Groups and Network design considerations
- Backup and Storage configuration – throughput to and from Vaults

We will cover the **technical details in depth at the next course**.
For now we need to understand ...

Choosing the right compute, network, storage etc. in order to **understand the costs** ....

Staring the design process

Topics we will cover:

- Designing over a long period … challenges with rapidly changing environment
    - MS Ignite just finished and I've had to rework large portions of this course.
- Network design considerations. You have to get it right from the start
- Choosing the right Virtual Machine types
- SLAs, availability and the impact on design/cost
- Tracking costs as you design

Services, functionality and limitations are **changing MONHTLY**...

Long running designs - challenges

Some of this might seem basic but its worth considering/implementing:

- Make all designs time dependant based on an agreed cut-off date (do the same for pricing)
- Cross reference all requirements with service descriptions. Try to list out the overall requirements e.g.:
    - Single datacentre location
    - Provision for one or more DMZ
    - VPN(s) to existing offices and datacentres
    - Extending Active Directory for VMs and PaaS Services
    - RTO and RPO of services
    - Documented recovery processes for each application/service

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Tracking Costs

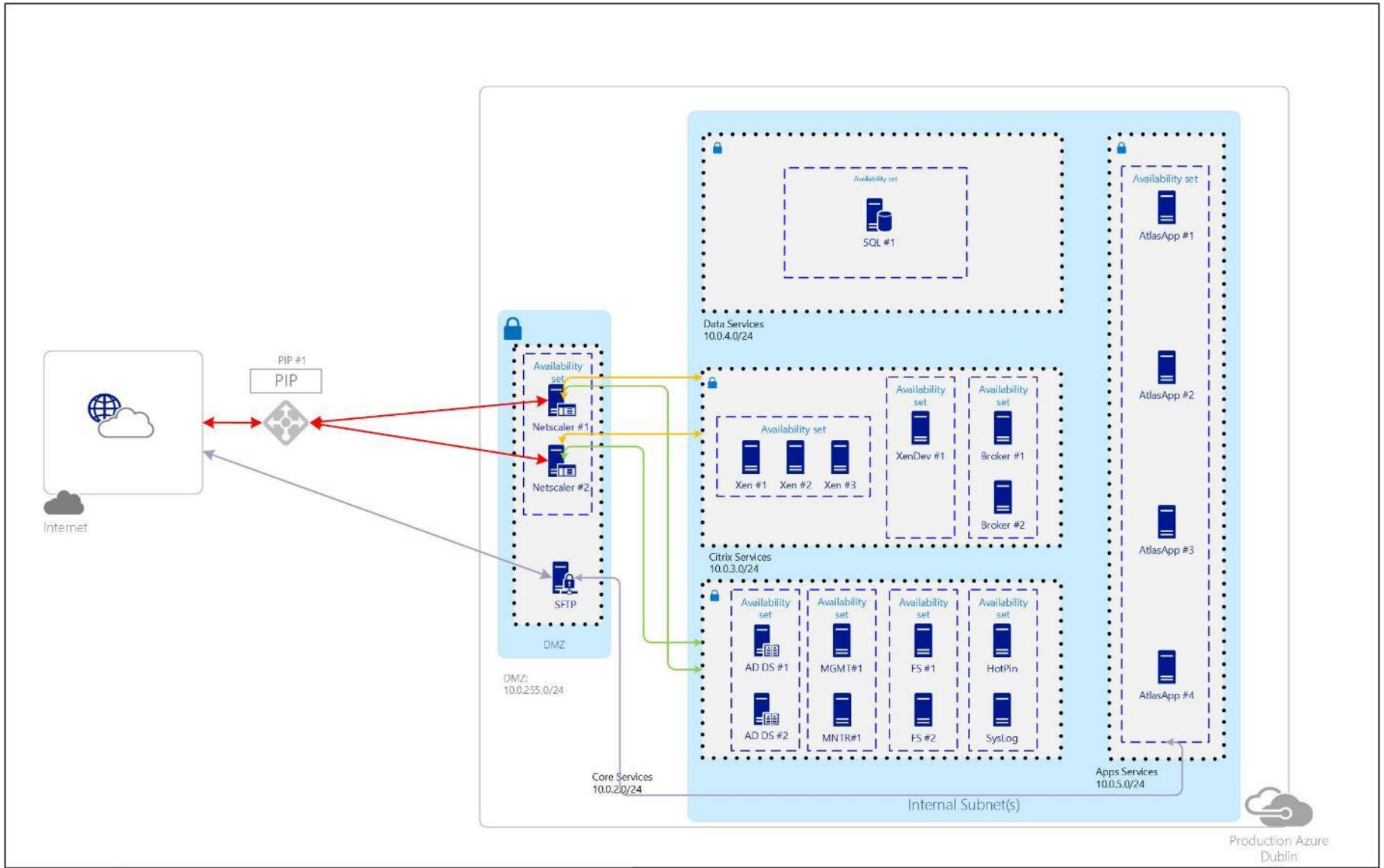
The major cost items include:

- Compute
- Storage
- Backup Data and Agent costs
- Outbound Network traffic

Minor cost items:

- Public IP's, Storage Transactions etc. ←Difficult to calculate and track

Lets walk through some **high level designs** ...



Sample Citrix Azure Design – Single Microsoft Datacentre in North Europe (Dublin). Showing the main network and subnet. Overlay with Virtual Machines, Availability Sets and Network Security Groups.

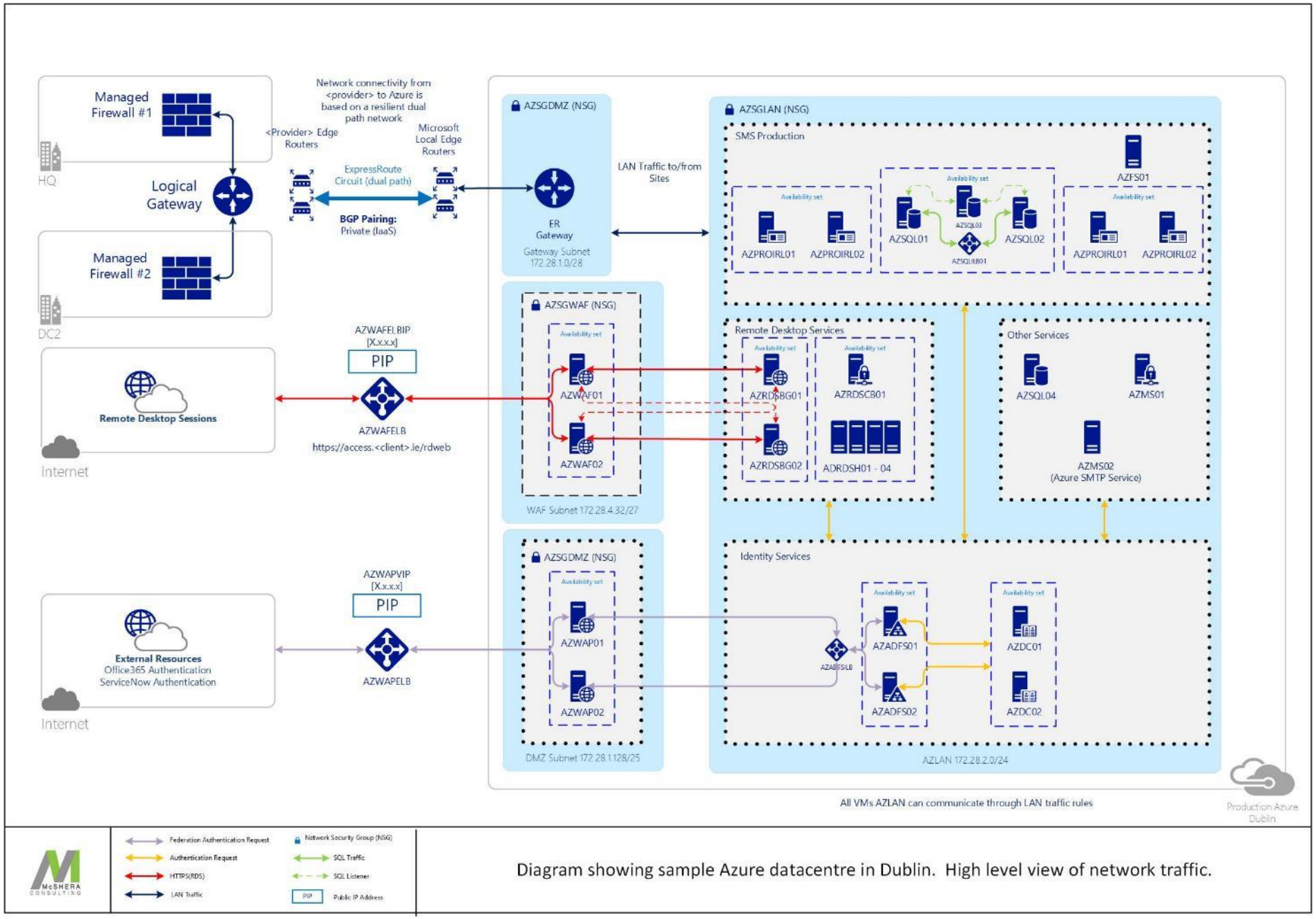


Diagram showing sample Azure datacentre in Dublin. High level view of network traffic.

Lets look at a **sample design and price** sheet for a real Azure environment …

Network

EVERY Azure network needs to consider/cater for the following:

- Gateways – ExpressRoute and/or VPN
- DMZ
- Perimeter devices
- Internal and External Load Balancers
- Role separation
- Make sure the address space is routable existing network. Even if it's not a current requirement
- Network Ingress is free. Egress has a cost.

Name	Address Space	Resource Group	Location	Name Servers
vnet01	10.0.0.0/16	abc-network-rg	North Europe	10.0.2.4;10.0.2.5

Subnet	Address Space	Virtual Network	Description
DMZ	10.0.255.0/24	vnet01	DMZ Services
GatewaySubnet	10.0.1.0/24	vnet01	Reserved for future VPN/ExpressRoute
Core	10.0.2.0/24	vnet01	Core shared services for VNET
XenApp	10.0.3.0/24	vnet01	All XenApp Services
Data	10.0.4.0/24	vnet01	All SQL and Data Services
abc	10.0.5.0/24	vnet01	All abc Application Services

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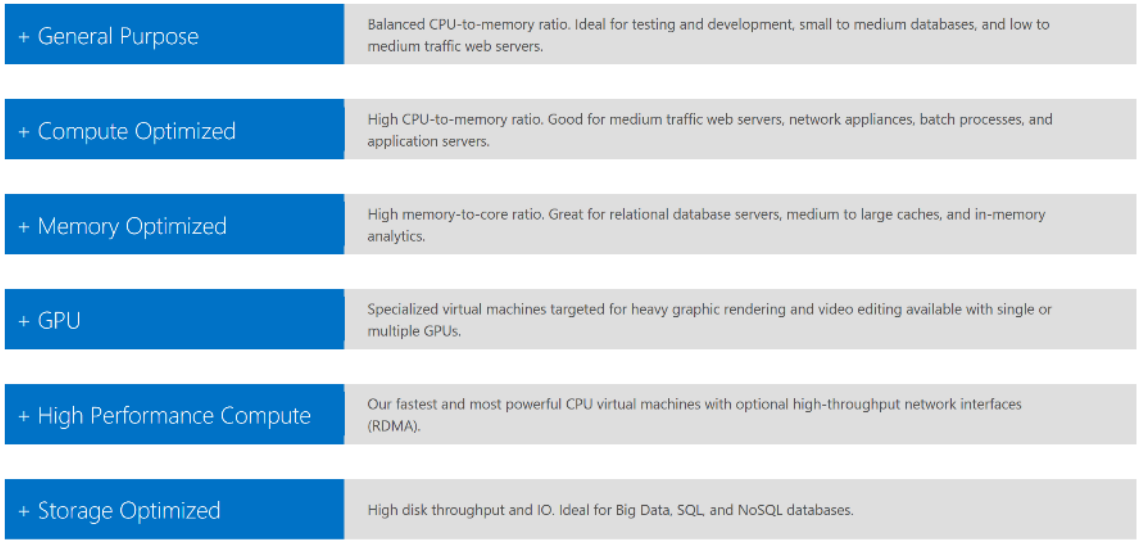
Storage for Backup

- Azure uses Recovery Services Vaults to retain backup data.
- Strongly recommend using Geo-Redundant Storage for all backup vaults. Its highly unlikely something would happen to data in an Azure datacentre … but don't take that risk.
- Backup costs are a combination of instance costs (agents) and the total amount of data.
- Actual storage required for Backup data depends on the retention required and the compression achieved. In short, its very difficult to determine in advance … but I'll show you some estimating techniques later.

Back to the **spreadsheet**

Choosing the right Virtual Machines

- There have been some attempts to make it easier to pick the right VM
- Main categories are →
- In reality its still:
  - A and Av2 Series
  - B Series (New)
  - D, Dv2 and Dv3 Series (v3 are new)
  - E Series (New)
  - F Series
  - G Series
  - H Series
  - NC Series
  - NV Series
- Regions are still limited e.g. G and N not available in North Europe.
- Premium storage variants have same compute costs e.g. D2v2 is same as DS2v2



https://azure.microsoft.com/en-us/pricing/details/virtual-machines/windows/

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Choosing the right Virtual Machines

- There is a pattern with VM sizes and cost
- Costs tend to double as you go up the band

INSTANCE	CORES	RAM	DISK SIZES [1]	PRICE
D1 v2	1	3.50 GiB	50 GB	€0.103/hr
D2 v2	2	7.00 GiB	100 GB	€0.206/hr
D3 v2	4	14.00 GiB	200 GB	€0.412/hr
D4 v2	8	28.00 GiB	400 GB	€0.824/hr
D5 v2	16	56.00 GiB	800 GB	€1.567/hr

INSTANCE	CORES	RAM	DISK SIZES [1]	PRICE
D11 v2	2	14.00 GiB	100 GB	€0.245/hr
D12 v2	4	28.00 GiB	200 GB	€0.49/hr
D13 v2	8	56.00 GiB	400 GB	€0.911/hr
D14 v2	16	112.00 GiB	800 GB	€1.64/hr
D15 v2	20	140.00 GiB	1,000 GB	€2.05/hr

- At the top end you have to really think about the application and what it needs for performance. The more cores the more expensive things become for applications e.g. SQL server.

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The **Dv3** and **Ev3** are **Hyperthreaded** cores. The Dv2 are physical cores. v3 are ~**28%** cheaper than v2.

Lets price something up and go through it from **start to finish**.
Any suggestions?

Some General Rules for Azure Design

- Lift and shift for applications with performance or capacity issue(s) will not work. Fresh re-implementation is the best approach for getting the most out of Azure
- Disk design and layout is critical to VM performance AND to costs. Stripping, cache settings, standard v's premium v's managed v's unmanaged etc
- Make sure that the applications are certified for Azure or at least on the Server Virtualisation Validation Program (SVVP).
  - https://support.microsoft.com/en-ie/help/2721672/microsoft-server-software-support-for-microsoft-azure-virtual-machines
  - https://www.windowsservercatalog.com/svvp.aspx

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