

T O W N O F C O H A S S E T
T E C H N O L O G Y R E F R E S H
A Z U R E , N E T W O R K A N D
C O S T A N A L Y S I S F I N D I N G S

DECEMBER 12, 2019

SUBSCRIPTION MODEL

Design

- Single Azure IaaS subscription sharing the same Office 365 tenant "cohassetma.onmicrosoft.org"
- Single Azure Resource Group containing the Azure Virtual Network, subnets, all Azure VMs, and the Azure FortiGate firewall.
- Point to On Premise VPN tunnel connecting the hybrid cloud configuration
- To allow dedicated subscription to shared services with a single point of control.

Design

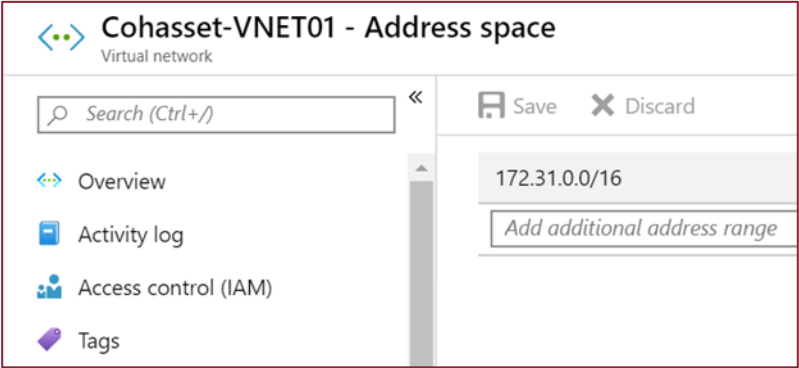
- Single Azure IaaS subscription sharing the same Office 365 tenant "cohassetma.onmicrosoft.org"

Design

- One Resource Group containing the VNET
- Reduce complexities of network and connectivity with the use of one VNET, with three separate subnets representing the three (3) On Premise Active Directories (TOC, CPD, CFD)
- Initially enable logging by use of features provided by Azure

Design

- Town of Cohasset will utilize a subnet per service strategy including required an NSG per subnet strategy, thus simplifying resource lockdown.
- "Cohasset-VNET01" will be created in Azure with 172.31.0.0/16 as the address space as determined during the design engagement
- Each Active Directory (TOC, CPD, and CFD) will have an AD Site called Azure Site defined



Design

- The Azure Cohasset Virtual Network will contain three subnets, segregated by an Azure based Fortigate Firewall

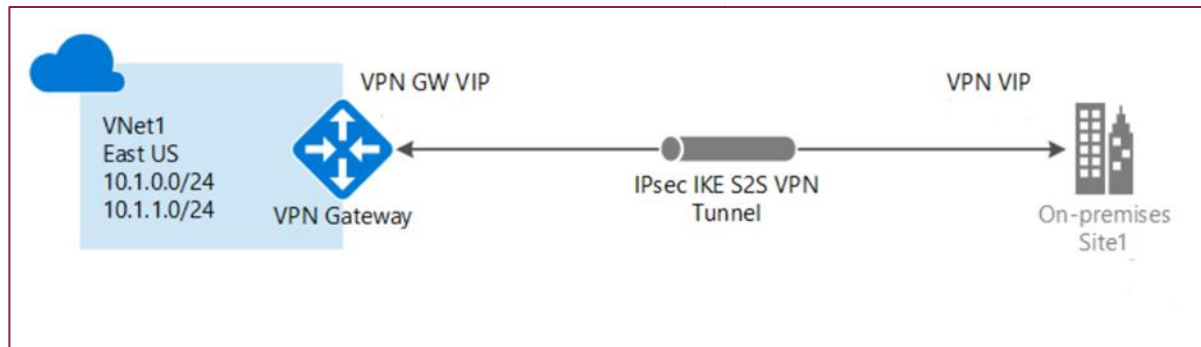
The screenshot shows the Azure portal interface for a virtual network named 'Cohasset-VNET01'. The page title is 'Cohasset-VNET01 - Subnets' with the subtitle 'Virtual network'. On the left, there is a navigation pane with options: Overview, Activity log, Access control (IAM), Tags, and Diagnose and solve problems. The main content area has a search bar 'Search (Ctrl+)' and two buttons: '+ Subnet' and '+ Gateway subnet'. Below these is a table of subnets with columns for Name, Address range, and IPv4 available addresses. The table lists three subnets: TOC-Subnet (172.31.10.0/24), CFD-Subnet (172.31.20.0/24), and CPD-Subnet (172.31.30.0/24), each with 251 IPv4 addresses available.

Name	Address range	IPv4 available ad...
TOC-Subnet	172.31.10.0/24	251
CFD-Subnet	172.31.20.0/24	251
CPD-Subnet	172.31.30.0/24	251

SITE TO SITE VPN

Design

- IntraSystems will install an Azure based Fortinet firewall which will facilitate the Point to Point (On Premise) VPN tunnel



Design

- SonicWALL NSA 5600 is on the Azure Validated VPN device list as long as you are running at a minimum SonicOS 5.8.x
- The Town of Cohasset has two Internet egress points one at CMHS and one at CEA
 - CMHS the primary circuit is 1Gbps from Comcast with a backup FiOS circuit that is 500Mbps
 - CEA the primary circuit is 500Mbps from FiOS with a backup Comcast circuit at 100Mbps
- IntraSystems recommends the FiOS circuit at CMHS act as the primary VPN circuit to Azure with the Comcast circuit at CEA as the backup to provide some ISP vendor diversity
- Updating the CEA Comcast circuit to 500Mbps to match the speed of the FiOS circuit at CMHS is recommended
- Switching from Primary to the Secondary circuit for the VPN connection to Azure would require that the IP SLA feature is available on the core switches
- IP SLA is also required to provide failover for internet egress

Design

- All Town of Cohasset Azure Virtual Machines will utilize Standard SSD Disks
- Locally Redundant Storage (LRS) will be utilized for all Virtual Machines
- All Town of Cohasset Azure VMs will utilize Managed Disks
- All Azure hosted Domain Controllers will have an additional Disk (E:) assigned for the NETLOGON and SYSVOL shares
 - A Default VM created in Azure has the disk configuration as described in the following table:

Disk Usage	Size	Type
Operating System Disk (C:\)	127 GB	*.vhd
Temporary Local Disk (D:\)	Depends on VM size and family	
Data Disk(s)	Customizable	*.vhd

Design

- Azure Files offers fully managed file shares in the cloud that are accessible via Server Message Block (SMB) protocol
- Town of Cohasset can leverage Azure Files to supplement or in some cases replace traditional On-Premise File shares, file servers, and typical NAS Devices
- As part of a complete solution Town of Cohasset can leverage Microsoft Azure File Shares. Benefits of this approach include:
 - Ease of replication and migration (also serve as Fault Tolerance for your Data)
 - Utilizing Azure File Shares can eliminate the need to maintain Windows OS based File servers
 - NTFS Permissions fully supported and migrate to the Azure File Share
 - Azure File Share Sync can synchronize or back up multiple on-premise locations to the cloud

AZURE IDENTITY - AZURE ACTIVE DIRECTORY

Design

- The Active Directory TOC is currently Synchronized via AD Connect to the Office 365 tenant
- If possible, the existing Office 365 tenant "cohassetma.onmicrosoft.org" will be utilized for Azure IaaS subscription
- Given the existence of only one production tenant, it is recommended that all Azure subscriptions use the same AAD tenant

Tenant	Custom Domains	Synchronization	Authentication
Cohassetma.onmicrosoft.org	▪ Cohassetma.org	Azure AD Connect	AAD Pass-through Authentication

UPN ALIGNMENT

INTRASYSTEMS

Design

- Microsoft recommends using a public routable UPN suffix for all cloud services. Town of Cohasset will ensure that all UPNs will be based on the public suffix @Cohassetma.org

ACTIVE DIRECTORY DOMAIN SERVICES ON AZURE

Design

- All three Active Directories (TOC, CDP, CFD) will be expanded or stretched to Azure
 - Create a site-to-site VPN between Town of Cohasset's on-premises infrastructure and Azure to leverage the on-premises Domain Controllers
 - Build a new AD Site, for each On Premise Active Directory, defined in ADSS for each AD
 - Standard D2s v3 (2 vcpus, 8 GiB memory) Azure VM sizing for the Domain Controllers

NAME RESOLUTION

Design

- All three Active Directories (TOC, CDP, CFD) will be expanded or stretched to Azure
 - To provide name resolution for Azure VMs and resolution of on-premises computers and service names to Azure VMs, DNS servers will be configured per Vnet
 - The VNET will be assigned the new Azure based Windows Domain Controller IP addresses for the VNET's DNS settings
 - For the servers deployed in Azure, Town of Cohasset needs to rely on the client-side registration
 - The required network setting "Use this connection's DNS suffix in DNS registration" is required

Design

- Recovery Vaults will be created in each in each Subscription to facilitate backup of VMs in each subscription
- It's recommended protecting the Recovery Vault using Multi-Factor Authentication (MFA)

Total storage identified during the initial assessment was approximately 17TB.

Backup Pricing	
SIZE OF EACH INSTANCE	AZURE BACKUP PRICE PER MONTH
Instance < or = 50 GB	\$5 + storage consumed
Instance is > 50 but < or = 500 GB	\$10 + storage consumed
Instance > 500 GB	\$10 for each 500 GB increment + storage consumed

Storage Pricing		
STORAGE CAPACITY	LRS	GRS
First 1 terabyte (TB) / month	\$0.024 per GB	\$0.048 per GB
Next 49 TB (1 to 50 TB) / month	\$0.0236 per GB	\$0.0472 per GB
Next 450 TB (50 to 500 TB) / month	\$0.0232 per GB	\$0.0464 per GB

MAINTENANCE & MONITORING VIRTUAL MACHINES

Design

Maintenance

- Azure IaaS virtual machines have the requirement to be maintained by Town of Cohasset
- Existing toolsets can be used to maintain the cloud environment, if supported by Azure

Monitoring

- Azure provides base-level infrastructure metrics and logs for most of its services
- Town of Cohasset will collect logs and metrics using an agent installed directly on the OS, provided by Splunk
- To collect and analyze the Activity Logs, it is suggested to leverage the Azure Log Analytics solution
- Network Watcher solution in Log Analytics and Network Performance Monitor will be utilized by Town of Cohasset

Design

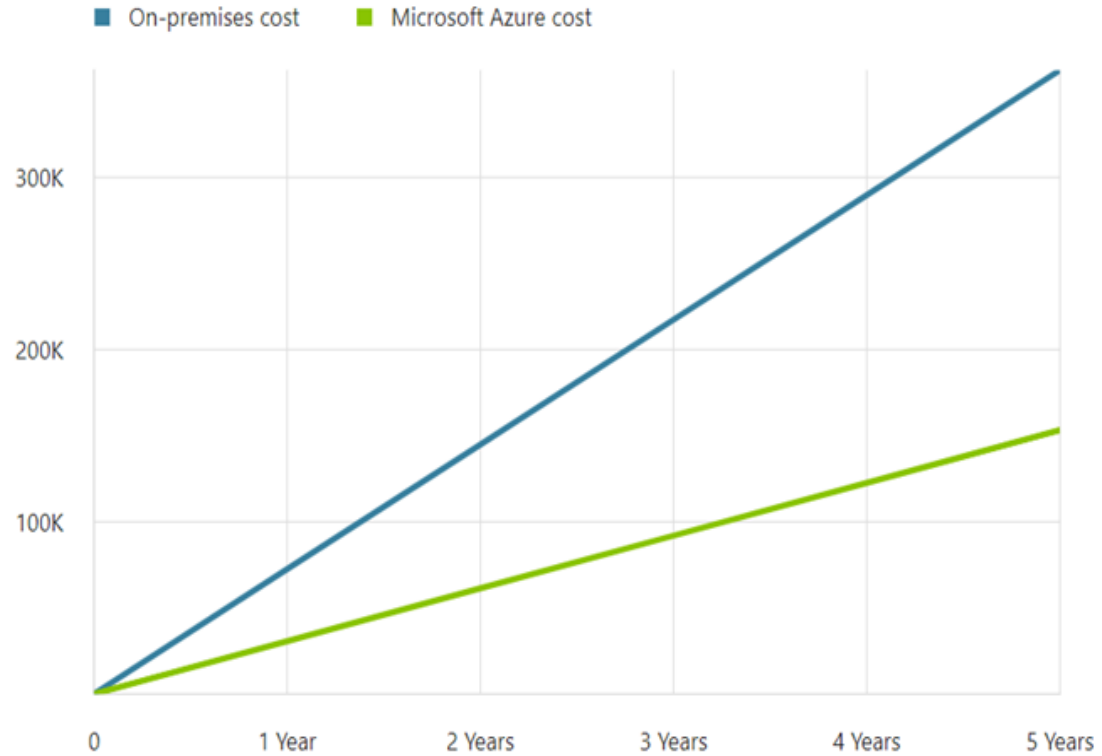
- It is recommended using multiple authentication factors for administrative accounts, regardless of certain conditions
 - The implementation of MFA is not in scope of this project, but highly recommended to secure the identities having access to the Azure management tools
- IntraSystems' recommendation is for Cohasset to upgrade their Azure AD licenses in their current tenant to Azure AD Premium 2 in order to have full access to Conditional Access Policies and Privileged Identity Management

T O W N O F C O H A S S E T
A Z U R E C O S T A N A L Y S I S T O
R E T I R E C E A D A T A C E N T E R
E S T I M A T E

5 YEAR COST SAVINGS - \$209,002

Total on-premises vs. Azure cost over time

Savings from running workloads in Azure accrue over time. The following shows how those savings add up over years.

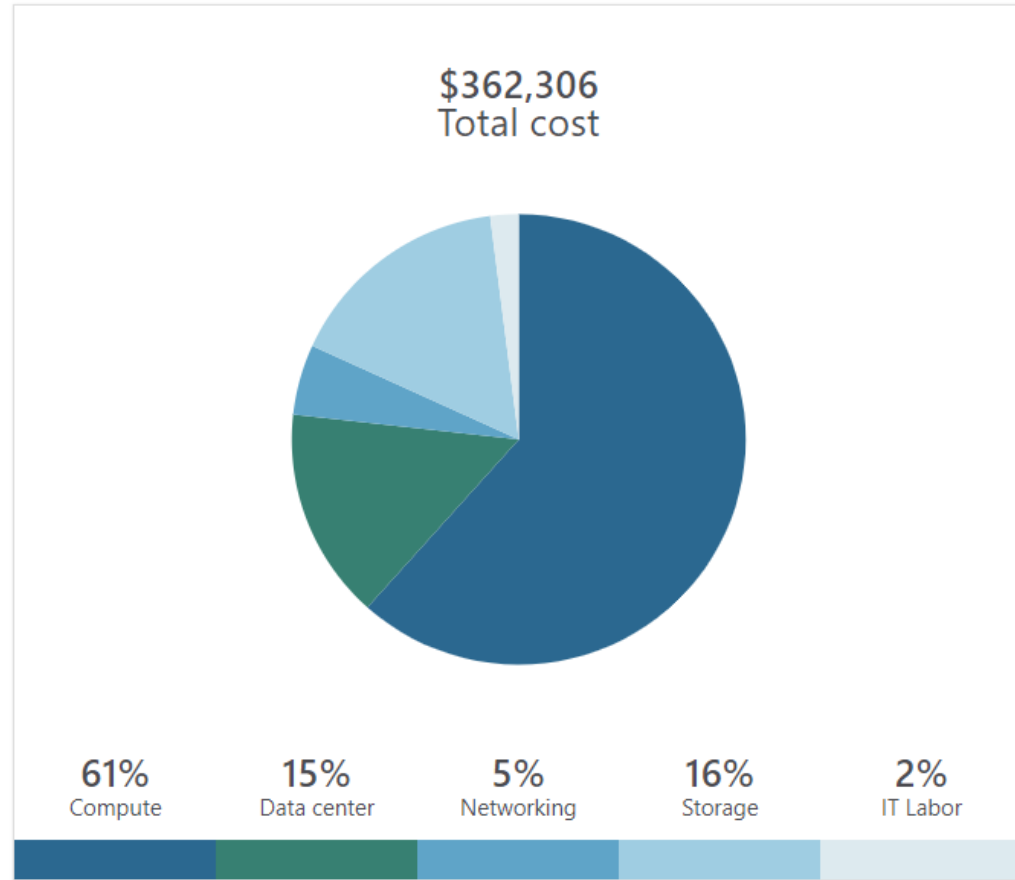


TOTAL COSTS

INTRASYSTEMS

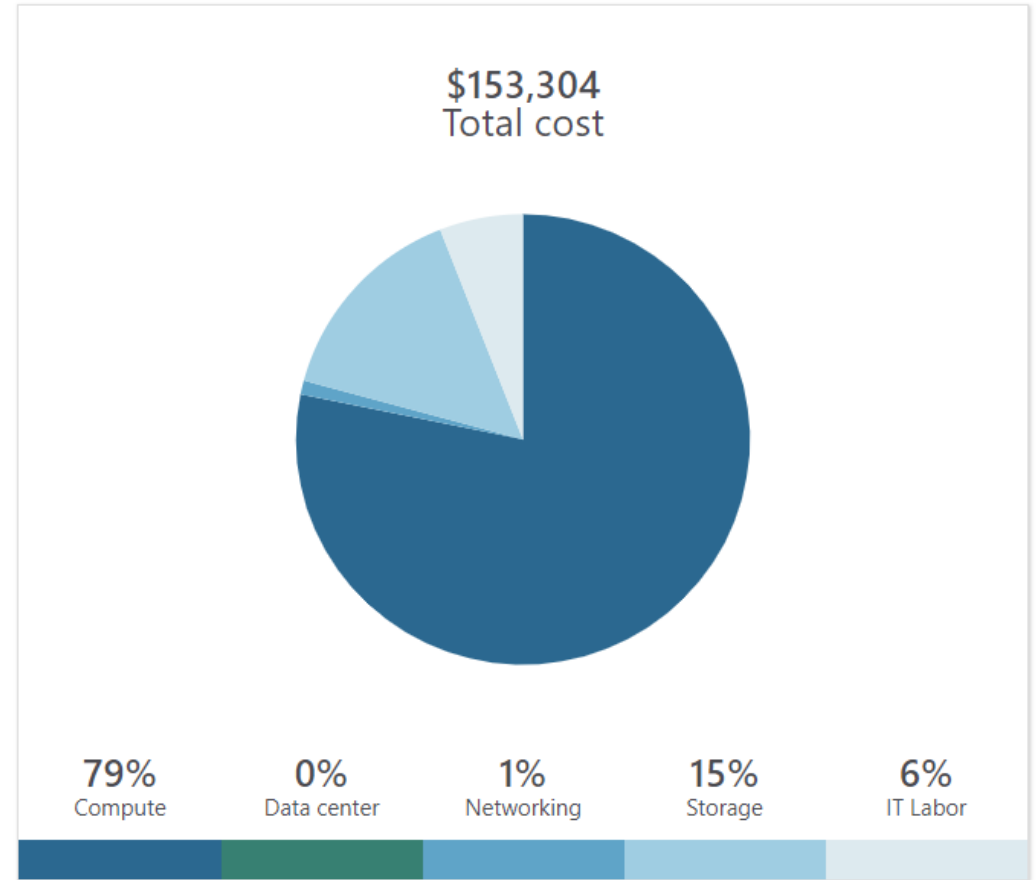
Total on-premises over 5 year(s)

TCO of on-premises environments tends to be driven by compute and data center costs.



Total Azure cost over 5 year(s)

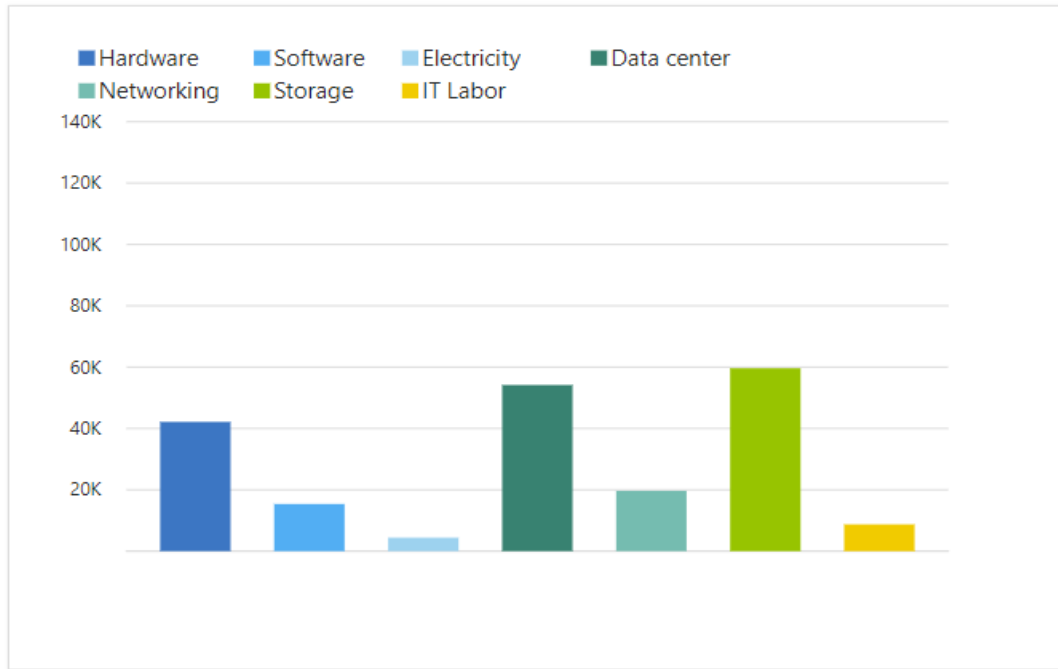
In Azure, certain cost categories decrease or go away completely.



COST BREAKDOWN

Total on-premises cost breakdown

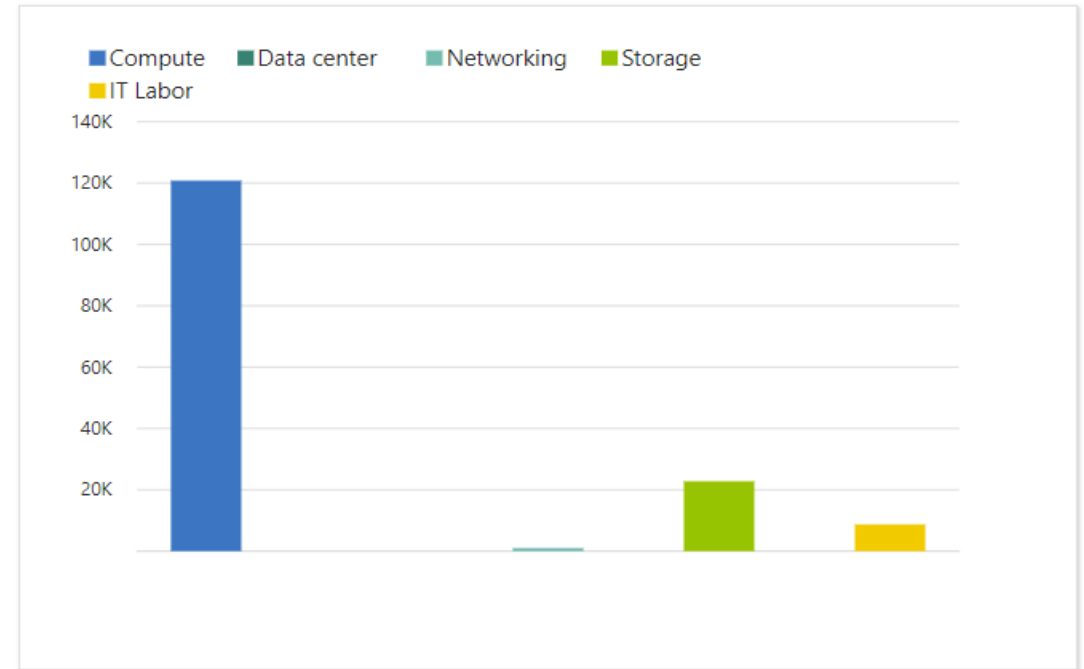
In Azure, several of the cost categories from the on-premises environment are consolidated and decrease with the efficiency that comes with the cloud.



\$362,306
Cost over 5 year(s)

Total Azure cost breakdown

In Azure, several of the cost categories from the on-premises environment are consolidated and decrease with the efficiency that comes with the cloud.



\$153,304
Cost over 5 year(s)

COST BREAKDOWN SUMMARY

On-premises cost breakdown summary		Azure cost breakdown summary	
Category	Cost	Category	Cost
Compute	\$220,150.60	Compute	\$120,790.92
Hardware	\$42,138.00	Data Center	\$0.00
Software	\$15,388.75	Networking	\$1,017.60
Electricity	\$4,407.60	Storage	\$22,775.76
Virtualization	\$42,060.00	IT Labor	\$8,720.00
Database	\$116,156.25		
Data Center	\$54,161.15		
Networking	\$19,658.03		
Storage	\$59,616.00		
IT Labor	\$8,720.00		
Total	\$362,306.00	Total	\$153,304.00

ON-PREMISES COMPUTE

Compute cost	
Hardware cost	
Virtual machine density - Number of virtual cores that can be created per physical core	2
Cost per 2 proc 8 core, 64 GB RAM virtualization server for Windows	\$14,105.00
Number of servers needed for 7 virtual machine(s) - 4 core, 8 GB RAM	1
Cost per 2 proc 4 core, 14 GB RAM virtualization server for Windows	\$6,964.00
Number of servers needed for 2 virtual machine(s) - 10 core, 8 GB RAM	1
Total cost for virtualization server(s)	\$21,069.00
Cost of maintaining virtualization server(s) - 20% of cost of virtualization server(s)	\$4,213.80
Total cost of maintaining server(s) over five year(s)	\$21,069.00
Total hardware cost over five year(s)	\$42,138.00

Software cost	
Cost of Windows data center license per 8 core, 64 GB RAM virtualization server	\$6,155.00
Number of servers needed for 7 virtual machine(s) - 4 core, 8 GB RAM	1
Cost of Windows data center license per 4 core, 14 GB RAM virtualization server	\$3,078.00
Number of servers needed for 2 virtual machine(s) - 10 core, 8 GB RAM	2
Total software license cost	\$12,311.00
Total Software Assurance cost	\$3,077.75
Total software cost over five year(s)	\$15,388.75

ON-PREMISES COMPUTE

Electricity cost

Price of electricity per kWh	\$0.10
Power rating of 8 core, 64 GB RAM server	682.3 Watts
Total electricity cost for 1 server(s) - 8 core, 64 GB RAM server per month	\$49.81
Power rating of 4 core, 14 GB RAM server	324 Watts
Total electricity cost for 1 server(s) - 4 core, 14 GB RAM server per month	\$23.65
Total electricity cost over five year(s)	\$4,407.60

Virtualization cost

Virtualization software license cost	\$13,980.00
Per virtual machine, per month, cost to load balance, backup and patch virtual machines	\$52.00
Number of virtual machines	9
Virtual machine management cost per month	\$468.00
Virtual machine management cost per year	\$5,616.00
Total virtualization cost over five year(s)	\$42,060.00

SQL Server VM Cost

Total CPU cores	10
SQL Server Standard License cost per 2 cores	\$3,717.00
Standard cores	10
Total license cost	\$92,925.00
Standard Software Assurance cost per 2 cores	\$929.25
Standard cores	10
Total Software Assurance cost	\$23,231.25
Total SQL Server VM cost over five year(s)	\$116,156.25

NOTE: A minimum of four core licenses are required for each physical processor on the server or VM

Total cost over five year(s)	\$220,150.60
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AZURE COMPUTE

Azure compute cost	
Virtual Machines cost	
Number of hours per month	730
F4sv2 Standard (4 core, 8 GB RAM) Windows (Azure Hybrid Benefit)	SKU# AAA-57372
Number of virtual machines	7
Total virtual machine cost per month	\$394.45
<hr/>	
Total Azure Virtual Machines cost	\$23,667.00
NOTE: For Azure compute costs, 3 year Reserved VM and two 1 year Reserved VM in use.	
SQL Server VM Cost	
Number of hours per month	730
F8sv2 Standard (8 core, 16 GB RAM) Windows, SQL Server Standard (Azure Hybrid Benefit)	SKU# N7H-07141
Number of virtual machines	2
Total virtual machine cost per month	\$1,618.732
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Total SQL Server VM cost over five year(s)	\$97,123.92

Total Azure compute cost over five year(s)	\$120,790.92
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ON-PREMISES DATA CENTER

Compute cost	
Number of rack units per rack	42
Rack units required per 8 core, 64 GB RAM server	4
Number of 8 core, 64 GB RAM server	1
Total number of rack units required	4
Rack units required per 4 core, 14 GB RAM server	2
Number of 4 core, 14 GB RAM server	1
Total number of rack units required	2
Total number of rack units required for all server(s)	6
Data center construction cost per rack unit amortized over 20 years	\$637.19
Data center compute cost	\$3,823.14
Total Data center compute cost over five year(s)	\$19,115.70
Storage cost	
Total number of rack units required for all storage	11
Number of rack units for DAS or SAN	11
Rack mounting/installation cost	\$7,009.09
Total Data center storage cost over five year(s)	\$35,045.45
Total Data center cost over five year(s)	\$54,161.15

ON-PREMISES NETWORKING

Networking cost

Total hardware + software cost over five year(s)	\$57,526.75
Network hardware and software cost assumed to be 25% of hardware and software cost over five year(s)	\$14,381.69
Network maintenance cost assumed to be 20% of network hardware and software cost over five year(s)	\$2,876.34
Service provider cost/GB per month	\$0.20
Amount of bandwidth needed (GB) per month	200
Total service provider cost per month	\$40.00
Total networking cost over five year(s)	\$19,658.03

Azure networking cost

Total outgoing bandwidth needed per month	200 GB
Total outgoing bandwidth cost per month	\$16.96

Total Azure networking cost over five year(s)	\$1,017.60
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ON-PREMISES STORAGE

Storage cost	
Hardware	
Local Disk/SAN-SSD Cost per GB	\$3.00
Storage (RAID 10 configuration) volume in GB	32
Local Disk/SAN-HDD Cost per GB	\$2.00
Storage (RAID 10 configuration) volume in GB	10,824
Total storage procurement cost	\$21,744.00
Backup	
Total backup and archive volume in GB	10,272
	HP LTO-7
	BB873A
Backup volume per tape in TB	6
Number of Tape drives required	6
Cost per Tape Drive	\$4,500.00
Backup and Archive cost over five year(s)	\$27,000.00
Storage Maintenance	
Storage maintenance cost (10% of storage procurement cost) over five year(s)	\$10,872.00
Total storage maintenance cost over five year(s)	\$10,872.00
Total storage cost over five year(s)	\$59,616.00

AZURE STORAGE

Azure storage cost	
Page Blob storage	
Usable storage volume in GB	2,994
Storage cost per GB/month	\$0.045
Annual storage cost per usable volume	\$1,616.76
Total Page Blob LRS storage maintenance cost over five year(s)	\$8,083.80
Backup	
Total backup and archive volume in GB	10,240
Storage cost per GB	\$0.0224
	SKU# AAA-70203
Backup and Archive maintenance cost over five year(s)	\$13,762.56
SQL Server VM storage cost	
Usable storage volume in GB	32
Azure disk match	P4
Total IOPS	120
Number of disks	1
Disk price per month	\$5.28
Usable storage volume in GB	64
Azure disk match	P6
Total IOPS	240
Number of disks	1
Disk price per month	\$10.21
Total Sql Server VM Storage cost over five year(s)	\$929.40
Total Azure storage cost over five year(s)	\$22,775.76



THANK
YOU!