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# PROPOSAL TO DEVELOP SOLUTIONS IN A NEXT GEN HYPERSCALE DATA CENTER

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Implementation and Test Results



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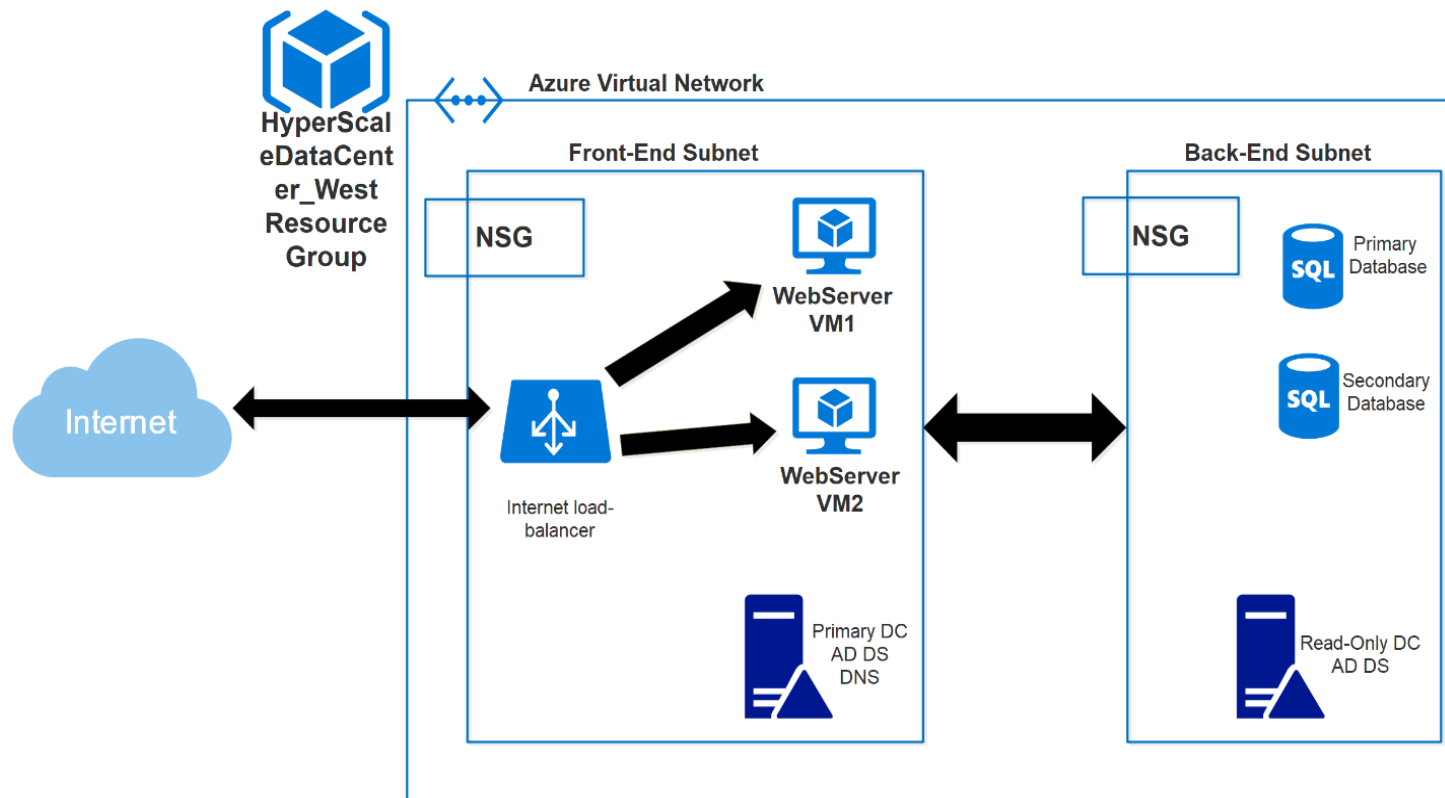
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## Implementation of the Infrastructure

### Infrastructure Diagram



Here I have created a Resource Group called the HyperScaleDataCenter\_West in the West Region of Microsoft Azure. Within the resource group I have created a Virtual Network. The Virtual Network acts as a router in the On-Premise physical environment.

Within the Virtual Network I have created two subnets, Front-End Subnet which will be facing the internet and a Back-End Subnet.

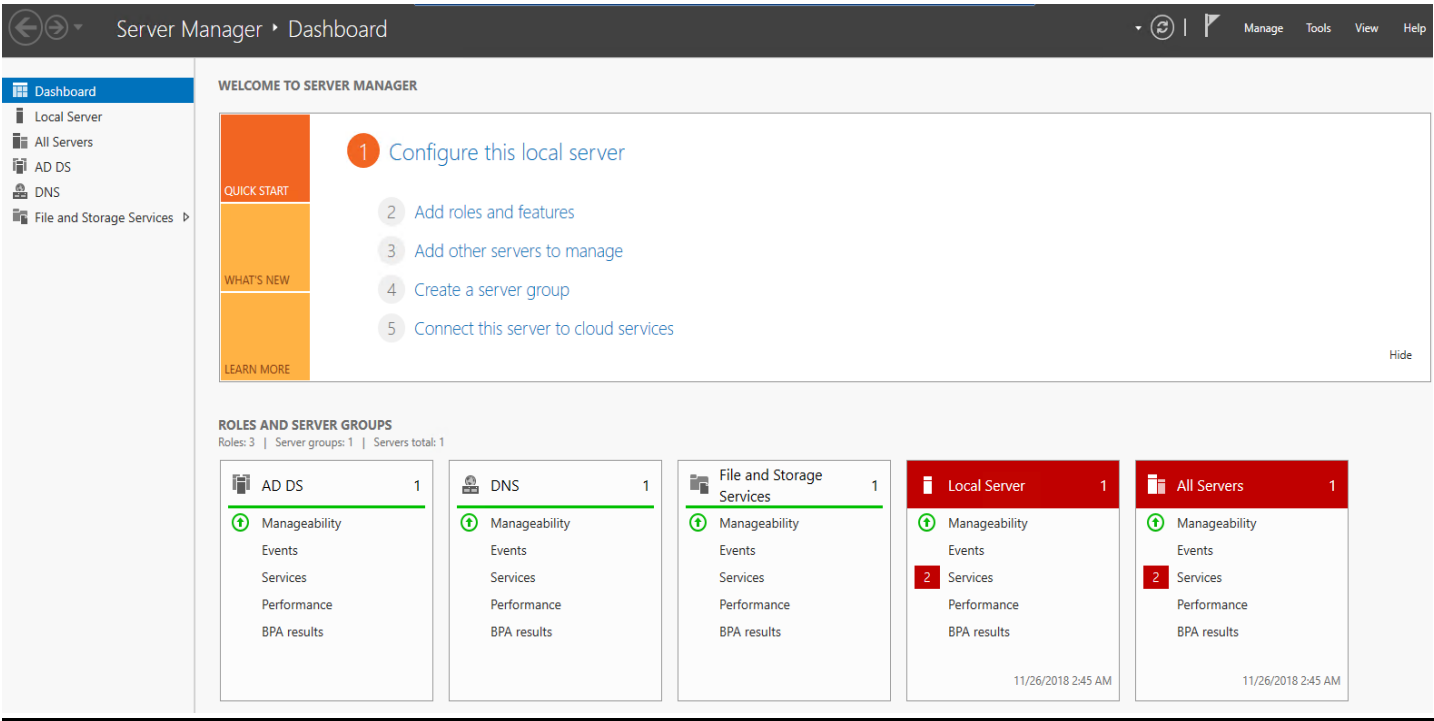
I have also created a Network Security Group (NSG) which will act as a Firewall in an On-Premise physical environment.

Within the Front-End Subnet we have an Internet facing load-balancer and two virtual machines that act as a Web Service (IIS) which will host the website and a Primary Domain Controller with DNS configured in it.

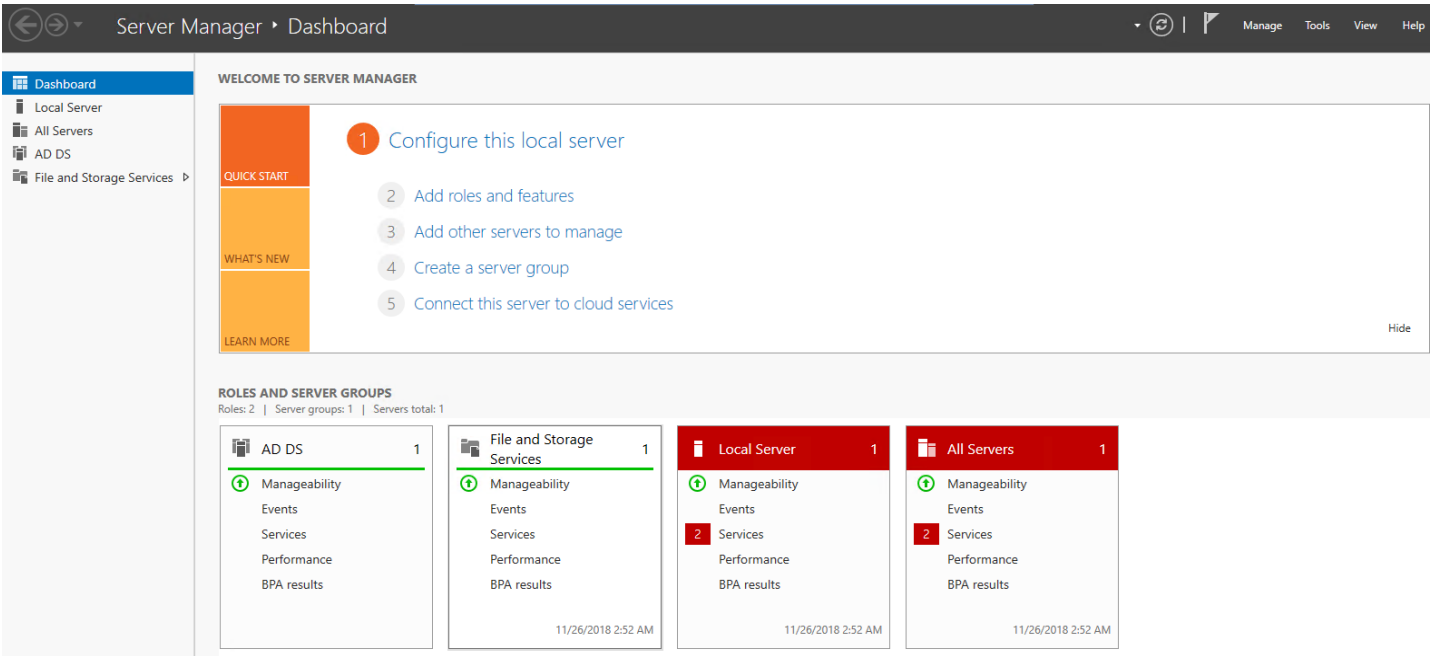
Within the Back-End Subnet we have a Primary and Secondary SQL Database with a Read-Only Domain Controller.

Primary and Secondary Domain Controller

Primary Domain Controller has been incorporated with Active Directory & DNS services for login and IP resolution and user rights.

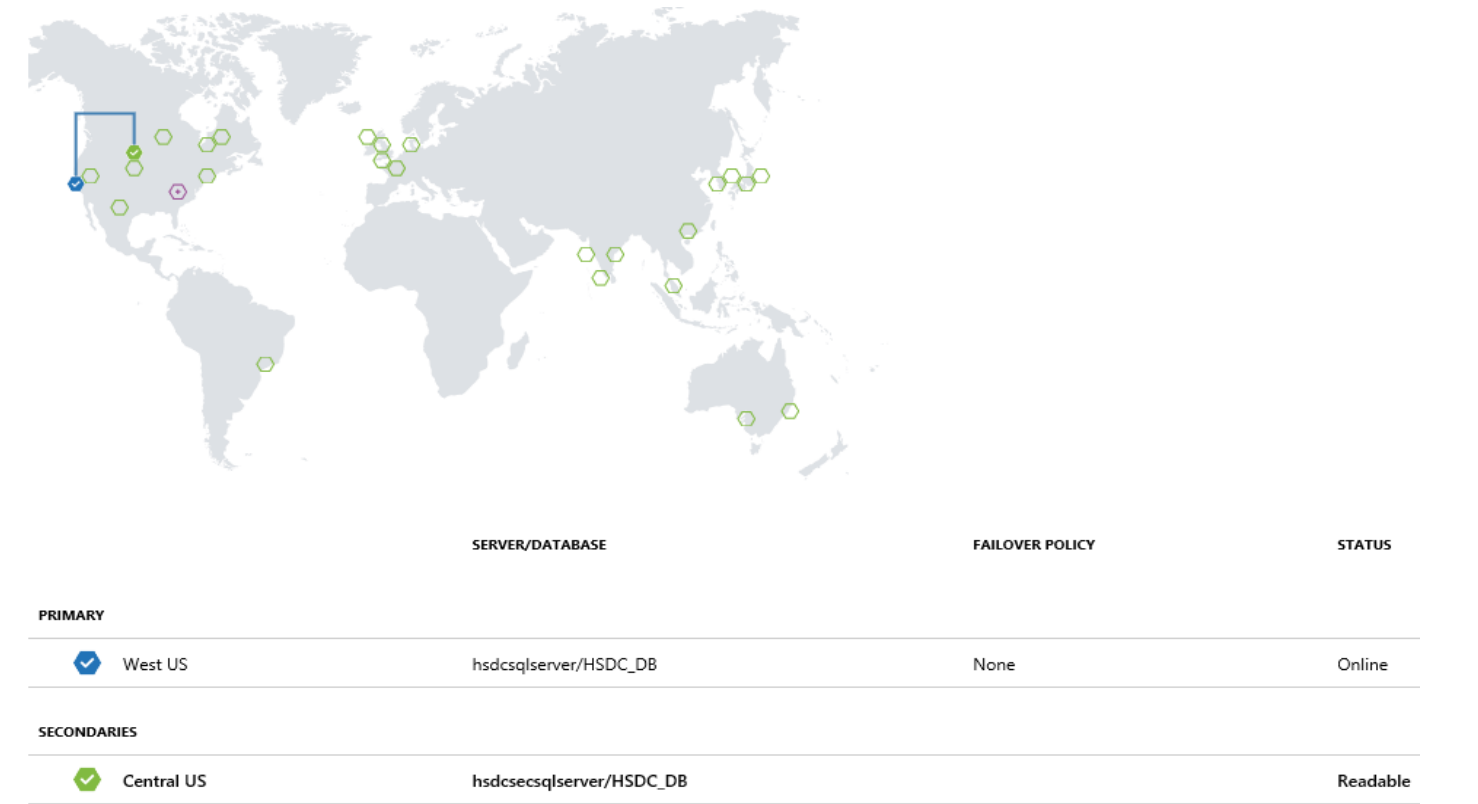


Secondary Domain Controller is only a Read-Only Domain Controller incorporated with Active Directory services for login and user rights.

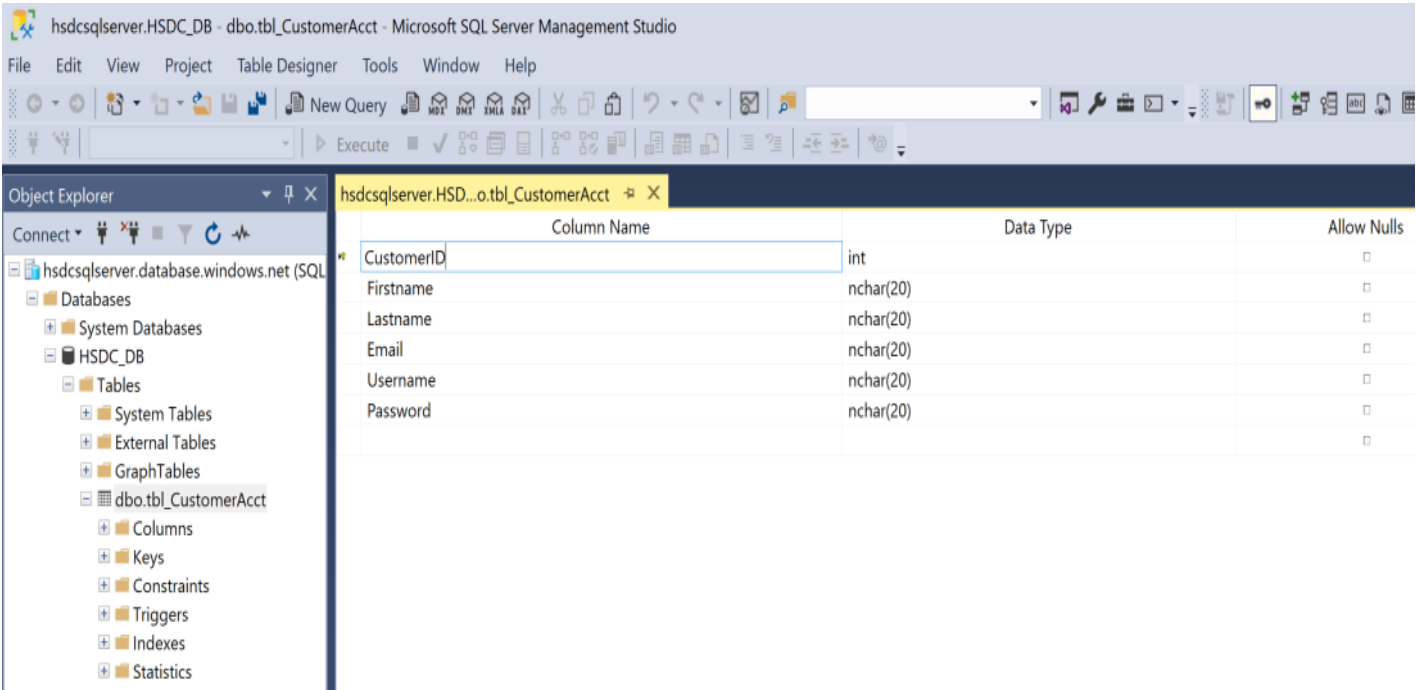


SQL Database

A SQL Database was developed in the West US region, and a Secondary SQL Database was developed and synced in the Central US region as a backup in case the West US region goes down.



A SQL Server is developed in SQL Server Management Studio to design and add data to the database.



Virtual Machines with Web Services (IIS)

Web Server 1

Server Manager

104.40.30.102

Server Manager > Dashboard

Dashboard

Local Server

All Servers

File and Storage Services >

IIS

WELCOME TO SERVER MANAGER

QUICK START

WHAT'S NEW

LEARN MORE

1

Configure this local server

2

Add roles and features

3

Add other servers to manage

4

Create a server group

5

Connect this server to cloud services

ROLES AND SERVER GROUPS

Roles: 2 | Server groups: 1 | Servers total: 1

File and Storage Services

1

Manageability

Events

Performance

BPA results

IIS

1

Manageability

Events

Services

Performance

BPA results

Local Server

1

Manageability

Events

1

Services

Performance

BPA results

11/26/2018 4:55 AM

All Servers

1

Manageability

Events

1

Services

Performance

BPA results

11/26/2018 4:55 AM

Web Server 2

Server Manager

40.83.165.69

Server Manager > Dashboard

Dashboard

Local Server

All Servers

File and Storage Services >

IIS

WELCOME TO SERVER MANAGER

QUICK START

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BPA results

IIS

1

Manageability

Events

Services

Performance

BPA results

Local Server

1

Manageability

Events

5

Services

Performance

BPA results

11/26/2018 5:00 AM

All Servers

1

Manageability

Events

5

Services

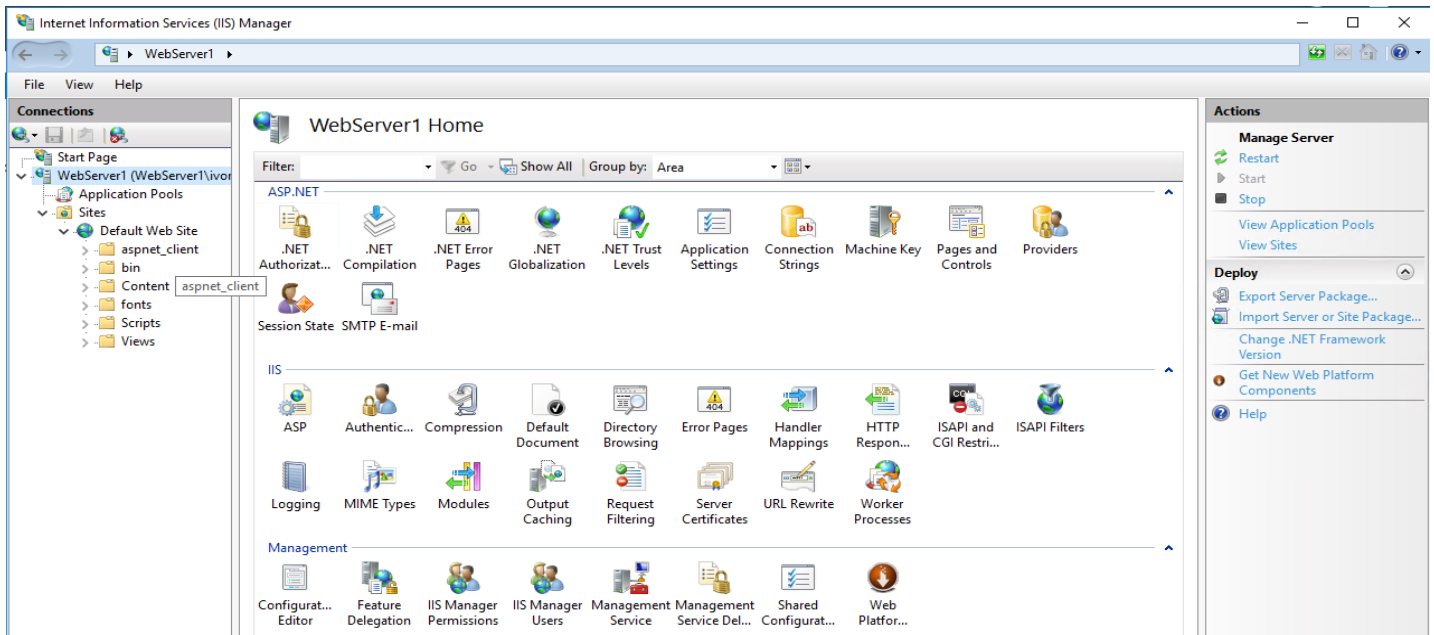
Performance

BPA results

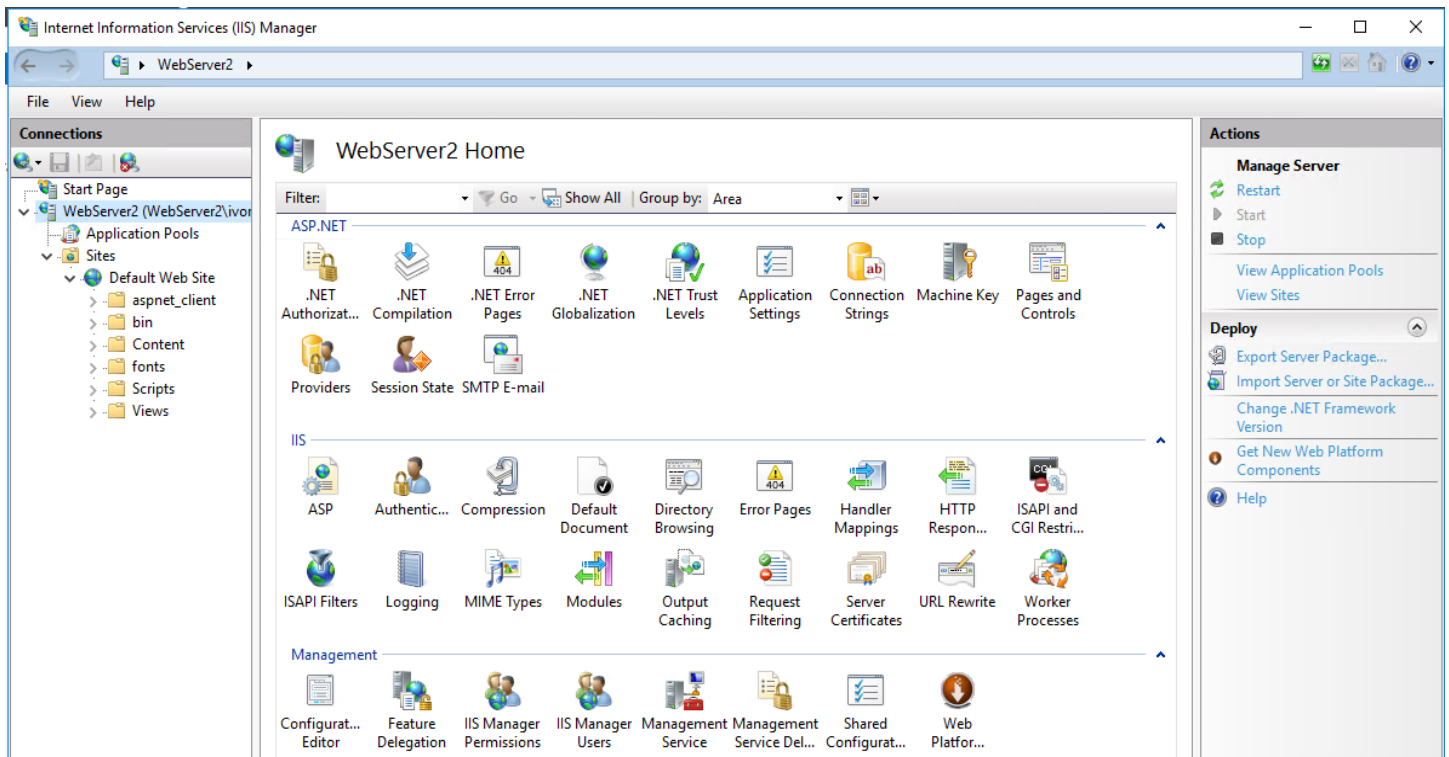
11/26/2018 5:00 AM

5

## Web Server 1 Internet Information Services



## Web Server 2 Internet Information Services



Functioning Website

The website was designed ASP.NET Web Application (.NET Framework). The website will show which server the load-balancer is currently using for demonstration purposes.

←

→

↺

🏠

🔒 Not secure | webserver1.westus.cloudapp.azure.com

Create your User Profile

You are on Web Server 1

First Name

Last Name

Email

Username

Password

Submit

Network Security Group (Virtual Firewall)

As you can see both subnets have been associated the HyperScaleDC\_NSG. Therefore, any virtual machines placed inside those subnets will automatically apply all security functions configured for that network security group.

Home > HyperScaleDataCenter\_West > HyperScaleDC\_NSG - Subnets

HyperScaleDC\_NSG - Subnets

Network security group

Search (Ctrl+I)

Overview

Activity log

Access control (IAM)

Tags

Diagnose and solve problems

Settings

Inbound security rules

Outbound security rules

Network interfaces

Subnets

+

Associate

Search subnets

NAME	ADDRESS RANGE	VIRTUAL NETWORK
FrontEndSubnet	10.4.0.0/24	HyperScaleDC_VN
BackEndSubnet	10.4.1.0/24	HyperScaleDC_VN



## TCP/IP Ports

The inbound security rules in Azure in the network security group shows all ports that are open. HTTP Port 80, RDP Port 3389, SSH Port 22, HTTPS Port 443 are open for the virtual machines. Port 8172 has been opened so that Visual Studio can publish the website into Azure Web Services using Web deploy Internet Information Services (IIS). Internet Control Message Protocol (ICMP) echo request has been allowed so that we could **ping** the Virtual Machines.

Home > HyperScaleDataCenter\_West > HyperScaleDC\_NSG - Inbound security rules

HyperScaleDC\_NSG - Inbound security rules  
Network security group

Search (Ctrl+/)

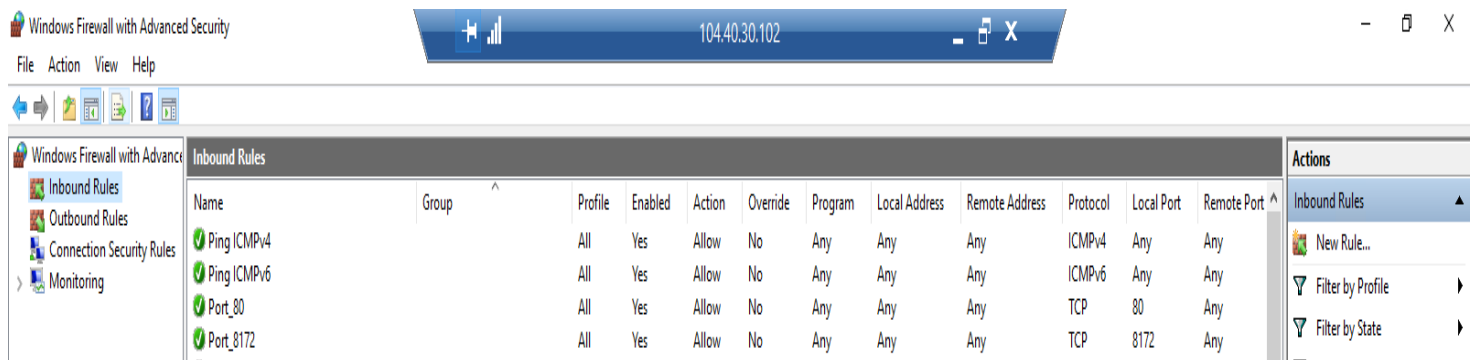
Overview  
Activity log  
Access control (IAM)  
Tags  
Diagnose and solve problems

Settings  
Inbound security rules  
Outbound security rules  
Network interfaces  
Subnets  
Properties

+ Add Default rules

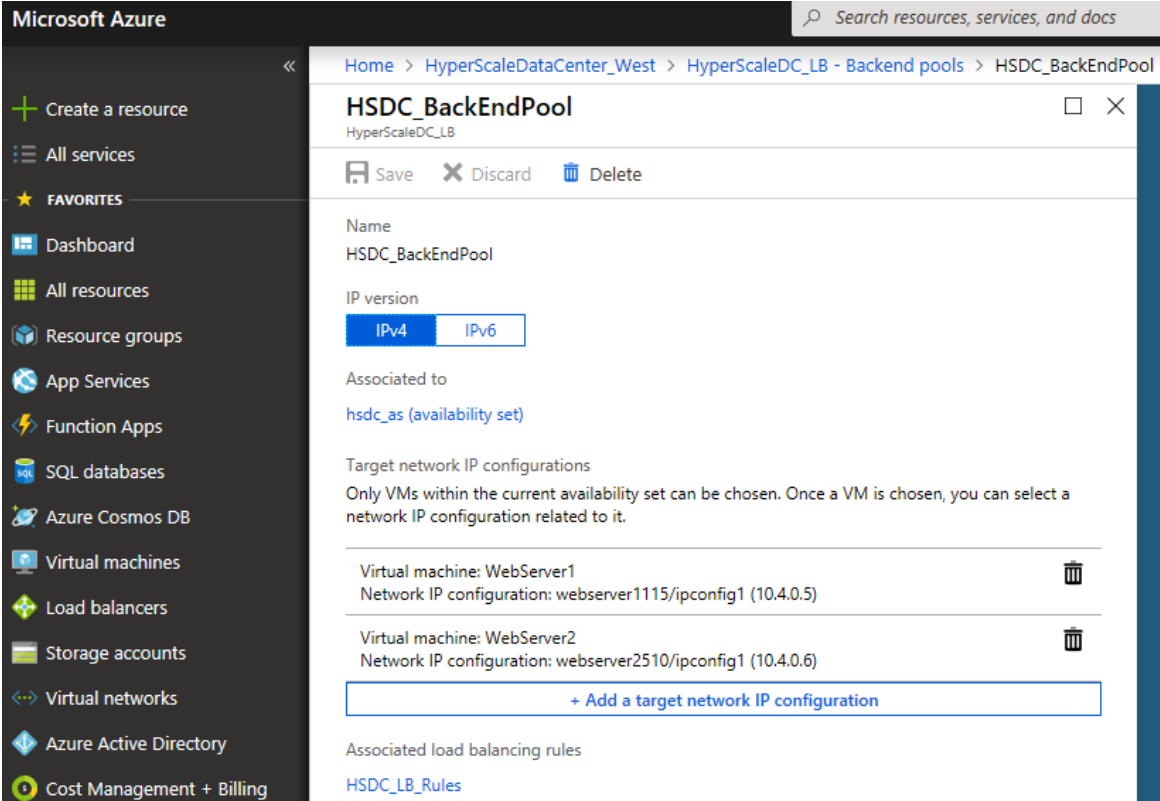
PRIORITY	NAME	PORT	PROTOCOL	SOURCE	DESTINATION	ACTION
100	Port_HTTP	80	TCP	Any	Any	Allow
110	Port_8172	8172	Any	Any	Any	Allow
120	ICMP	Any	Any	Any	Any	Allow
150	Port_RDP	3389	TCP	Any	Any	Allow
300	Port_HTTPS	443	TCP	Any	Any	Allow
400	Port_SSH	22	Any	Any	Any	Allow
65000	AllowVnetInBound	Any	Any	VirtualNetwork	VirtualNetwork	Allow
65001	AllowAzureLoadBalancerInBound	Any	Any	AzureLoadBalancer	Any	Allow
65500	DenyAllInBound	Any	Any	Any	Any	Deny

Even though the ports were open in the Azure Network Security groups, we still have to create the inbound rules for Port 80, Port 8172, ICMPv4 and ICMPv6 inside the virtual machines Firewall settings.



Load-Balancer

The load-balancer created in Azure shows both Webservers added to the Back-End Pool.



## Test Results of the Infrastructure

### Distribute Traffic between Web Servers

We are testing if public IP Address (168.61.19.231) assigned to the Load-Balancer is pulling our website. As you can see the website is hosted by our Web Server 1. Since its very healthy.

← → ↻ 🏠

📄 168.61.19.231/

Create your User Profile

You are on Web Server 1

First Name

Brit

Last Name

Staples

Email

bstaples@gmail.com

Username

bstaples

Password

••••••••

Submit

I have hit submit and now we are going to access our database using SQL Server Management Studio to see if the data was added to the database. As you can see below that it was successfully added.

100 %						
Results Messages						
	CustomerID	Firstname	Lastname	Email	Username	Password
1	1	Ivor	Leon	Leon@gmail.com	ivor123	qazwsx
2	2	Shannon	Leon	sleon@gmail.com	sleon123	edcrfv
3	3	Berney	Leon	bleon@gmail.com	bleon	thnbu
4	4	Jesme	Leon	jleon@gmail.com	jleon	ujmivr
5	5	Leena	Leon	lleon@gmail.com	lleon	ynugh
6	6	Skyler	Leon	sleon@gmail.com	sleon2016	ikmnjuy
7	7	Tom	smith	tsmith@gmail.com	tsmith	wstgbyh
8	8	Jack	Logan	jlogan@gmail.com	jlogan	yhnbueh
9	9	Jackie	Chan	jchan@gmail.com	jchan	jfnvmki
10	10	Mike	Lee	mlee@gmail.com	mlee	yhnbweyu
11	11	Siri	Swenson	ss@gmail.com	ss	hgnjcuv
12	12	Kofi	Silver	ksilver@gmail.com	ksilver	kevnrbfe
13	13	Brit	Staples	bstaples@gmail.com	bstaples	bnjcbvhytd

Now I will go ahead and shutdown Web Server 1, to simulate the situation that the Web Server 1 is down. As you can see that the Web Server 1 is stopped and deallocated.

NAME	STATUS	FAULT DOMAIN	UPDATE DOMAIN
WebServer1	Stopped (deallocated)	0	0
WebServer2	Running	1	1

Now we will try to go to our website and you can see that the load-balancer has directly gone to the Web Server 2 virtual machine.

← → ↺ 🏠
104.40.29.217/

Create your User Profile

You are on WebServer2

First Name

Last Name

Email

Username

Password

I have hit submit and now we are going to access our database using SQL Server Management Studio to see if the data was added to the database via Web Server 2. As you can see below that it was successfully added.

Results		Messages				
	CustomerID	Firstname	Lastname	Email	Username	Password
1	1	Ivor	Leon	Leon@gmail.com	ivor123	qazwsx
2	2	Shannon	Leon	sleon@gmail.com	sleon123	edcrfv
3	3	Berney	Leon	bleon@gmail.com	bleon	thnbu
4	4	Jesme	Leon	jleon@gmail.com	jleon	ujmnr
5	5	Leena	Leon	lleon@gmail.com	lleon	ynugh
6	6	Skyler	Leon	sleon@gmail.com	sleon2016	ikmnjuy
7	7	Tom	smith	tsmith@gmail.com	tsmith	wstgbyh
8	8	Jack	Logan	jlogan@gmail.com	jlogan	yhnrbueh
9	9	Jackie	Chan	jchan@gmail.com	jchan	jfnvmki
10	10	Mike	Lee	mlee@gmail.com	mlee	yhnrbweyu
11	11	Siri	Swenson	ss@gmail.com	ss	hgnjcuv
12	12	Kofi	Silver	ksilver@gmail.com	ksilver	kcvnybfs
13	13	Brit	Staples	bstaples@gmail.com	bstaples	bnicbvhvtd
14	14	Mitch	Donley	mdonley@microsoft.co	mdonley	kknjodg4657hb

### Test Virtual Firewalls for ICMP Traffic

Now I will test the load-balancer IP Address (104.40.29.217) to verify if the TCP connection goes through. Both virtual machines have set to dynamic IP Addresses. Therefore, every time the machine is started it will have a different IP Address. I will be using PowerShell to test the connection. As you can see below the TCP Test Succeeded.

Windows PowerShell

```
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

PS C:\Users\iatki> Test-NetConnection 104.40.29.217 -port 80

ComputerName      : 104.40.29.217
RemoteAddress     : 104.40.29.217
RemotePort        : 80
InterfaceAlias    : Wi-Fi
SourceAddress     : 192.168.0.10
TcpTestSucceeded  : True

PS C:\Users\iatki>
```

Now I will test Web Server 1 and Web Server 2 to very if I am able to ping both the servers via ICMP. Web Server 1 currently has an IP Address of 40.112.198.7 and Web Server 2 currently has an IP Address of 40.83.165.69. As you can see below it was successful.

Windows PowerShell

```
PS C:\Users\iatki> ping 40.112.198.7

Pinging 40.112.198.7 with 32 bytes of data:
Reply from 40.112.198.7: bytes=32 time=32ms TTL=110
Reply from 40.112.198.7: bytes=32 time=32ms TTL=110
Reply from 40.112.198.7: bytes=32 time=30ms TTL=110
Reply from 40.112.198.7: bytes=32 time=32ms TTL=110

Ping statistics for 40.112.198.7:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 30ms, Maximum = 32ms, Average = 31ms
PS C:\Users\iatki> █
```

```
PS C:\Users\iatki> ping 40.83.165.69

Pinging 40.83.165.69 with 32 bytes of data:
Reply from 40.83.165.69: bytes=32 time=31ms TTL=110
Reply from 40.83.165.69: bytes=32 time=31ms TTL=110
Reply from 40.83.165.69: bytes=32 time=33ms TTL=110
Reply from 40.83.165.69: bytes=32 time=31ms TTL=110

Ping statistics for 40.83.165.69:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 31ms, Maximum = 33ms, Average = 31ms
PS C:\Users\iatki>
```

I have setup three alert rules under the metrics. The rules are to alert the Administrator if the CPU Percentage is greater than 80% on both web servers and SQL Database.

## Rules

Rules management

+ New alert rule
≡ Edit columns
👤 Manage action groups
🔔 View classic alerts
🔄 Refresh
▶ Enable
■ Disable
🗑 Delete

\* Subscription ⓘ

Microsoft Azure Sponsorship 2

Resource group ⓘ

HyperScaleDataCenter\_West

Resource type ⓘ

5 selected

Resource ⓘ

Type to start filtering ...

Signal type ⓘ

All sources

Status ⓘ

Enabled

[Microsoft Azure Sponsorship 2](#) > [HyperScaleDataCenter\\_West](#)

📘 Click on "View classic alerts" to view rules configured in Alerts (classic).

Displaying 1 - 3 rules out of total 3 rules

NAME	CONDITION	STATUS	TARGET RESOURCE	TARGET RESOURCE TYPE	SIGNAL TYPE
<a href="#">Percentage CPU Greater than 80</a>	Percentage CPU GreaterThan 80	🟢 Enabled	WebServer1	Virtual machines	Metrics
<a href="#">WebServer2 - Percentage CPU Greater than 80</a>	Percentage CPU GreaterThan 80	🟢 Enabled	WebServer2	Virtual machines	Metrics
<a href="#">Database Percentage CPU Greater than 80</a>	category equals Administrative and resourceId equals /subscriptions/ec444...	🟢 Enabled	HSDC_DB	SQL databases	Service notifications

## All Alerts

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