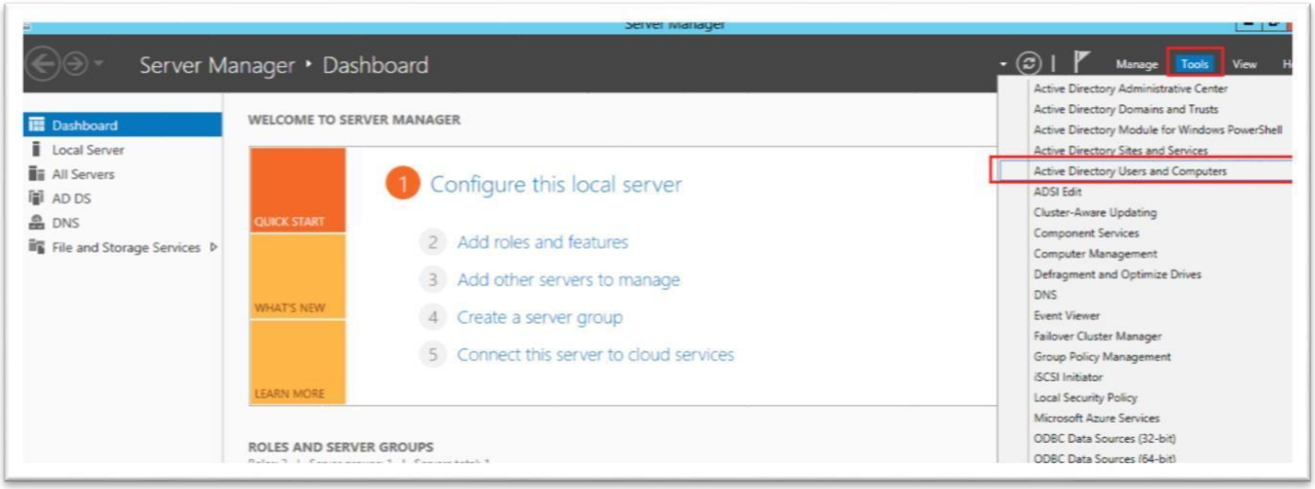
Configuring a SQL Server AlwaysOn High Availability Group

In this article, we will learn the step by step configuration of SQL Server AlwaysOn High availability Group for two nodes. Once nodes are added to the cluster group, we will able to use the AlwaysOn feature in the SQL server.

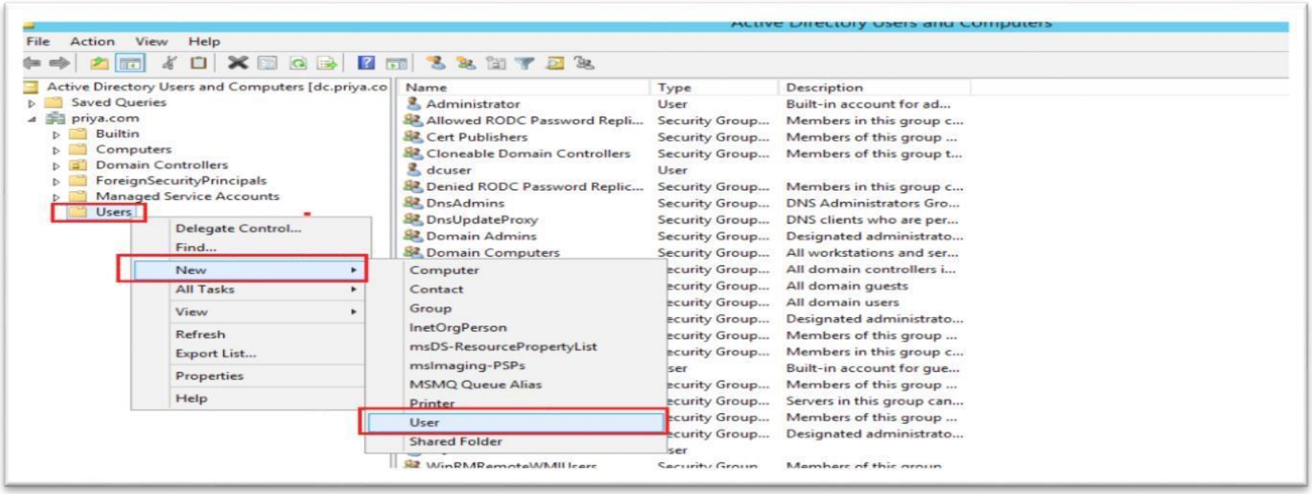
In the following steps, we will create a Service account to connect SQL server instances. The Service account will be used to connect the SQL instance from both the node servers.

Create a Service Account

We will log in to the Domain controller and perform the following steps. Open **Server Manager**, **Tools** and Click **Active Directory Users and Computers**.

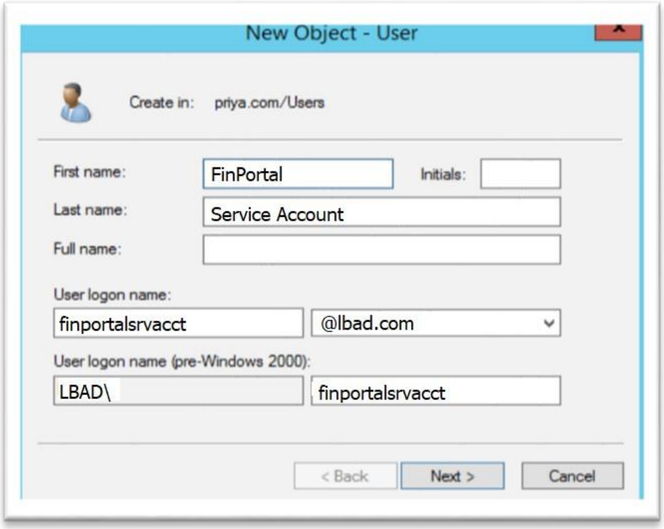

Server Manager
Server Manager • Dashboard
Manage
Tools
View
Dashboard
Local Server
All Servers
AD DS
DNS
File and Storage Services
WELCOME TO SERVER MANAGER
QUICK START
WHAT'S NEW
LEARN MORE
1 Configure this local server
2 Add roles and features
3 Add other servers to manage
4 Create a server group
5 Connect this server to cloud services
ROLES AND SERVER GROUPS
Active Directory Administrative Center
Active Directory Domains and Trusts
Active Directory Module for Windows PowerShell
Active Directory Sites and Services
Active Directory Users and Computers
ADSI Edit
Cluster-Aware Updating
Component Services
Computer Management
Defragment and Optimize Drives
DNS
Event Viewer
Failover Cluster Manager
Group Policy Management
iSCSI Initiator
Local Security Policy
Microsoft Azure Services
ODBC Data Sources (32-bit)
ODBC Data Sources (64-bit)

In Active Directory Users and Computers window, **Right-Click Users > New > User** as shown in the following Fig.



Name	Type	Description
Administrator	User	Built-in account for ad...
Allowed RODC Password Repli...	Security Group...	Members in this group c...
Cert Publishers	Security Group...	Members of this group ...
Cloneable Domain Controllers	Security Group...	Members of this group t...
dcuser	User	
Denied RODC Password Replic...	Security Group...	Members in this group c...
DnsAdmins	Security Group...	DNS Administrators Gro...
DnsUpdateProxy	Security Group...	DNS clients who are per...
Domain Admins	Security Group...	Designated administrato...
Domain Computers	Security Group...	All workstations and ser...
	ecurity Group...	All domain controllers i...
	ecurity Group...	All domain guests
	ecurity Group...	All domain users
	ecurity Group...	Designated administrato...
	ecurity Group...	Members of this group ...
	ecurity Group...	Members in this group c...
	ser	Built-in account for gue...
	ecurity Group...	Members of this group ...
	ecurity Group...	Servers in this group can...
	ecurity Group...	Members of this group ...
	ecurity Group...	Designated administrato...
	ser	
WinRMRemoteWMIUsers	Security Group	Members of this group

In this step, we will create a Service account username, Specify the service account login name and Click Next



Create in: priya.com/Users

First name: FinPortal

Initials:

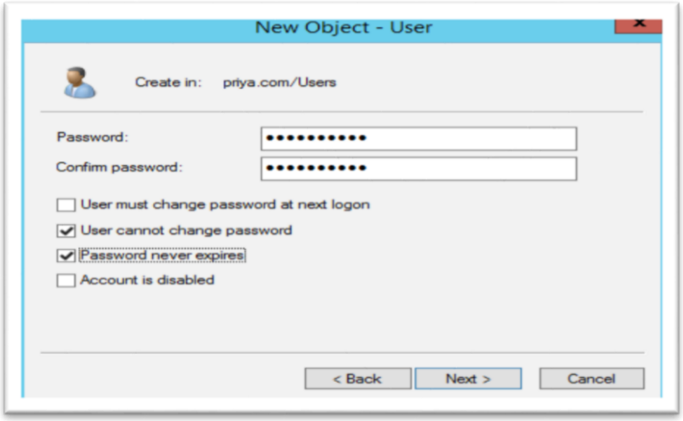
Last name: Service Account

Full name:

User logon name: finportalsrvacct @lbad.com

User logon name (pre-Windows 2000): LBAD\ finportalsrvacct

Specify a Password and tick the options for **User cannot change password** and **Password never expires**. We need to select **Password never expires** option because, if the password expired, the service account login would fail, and it will cause a problem to the high availability configuration.



Create in: priya.com/Users

Password: •••••••••••

Confirm password: •••••••••••

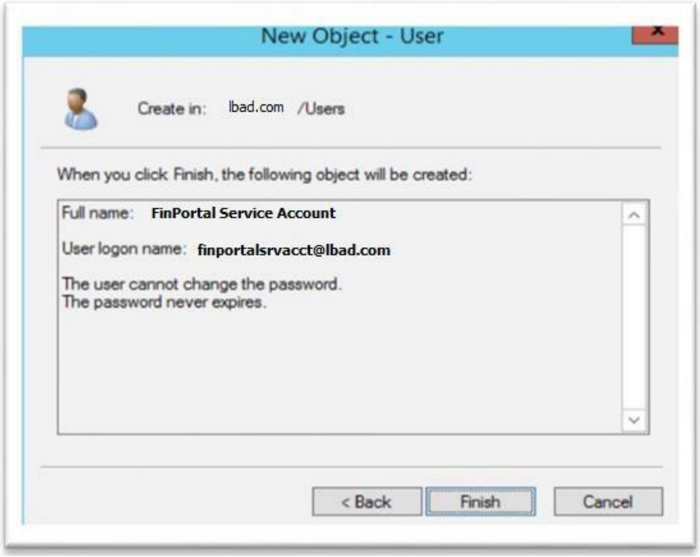
☐ User must change password at next logon

☑ User cannot change password

☑ Password never expires

☐ Account is disabled

Click **Finish** to complete the service account creation process.



Create in: lbad.com /Users

When you click Finish, the following object will be created:

Full name: **FinPortal Service Account**

User logon name: **finportalsrvacct@lbad.com**

The user cannot change the password.
The password never expires.

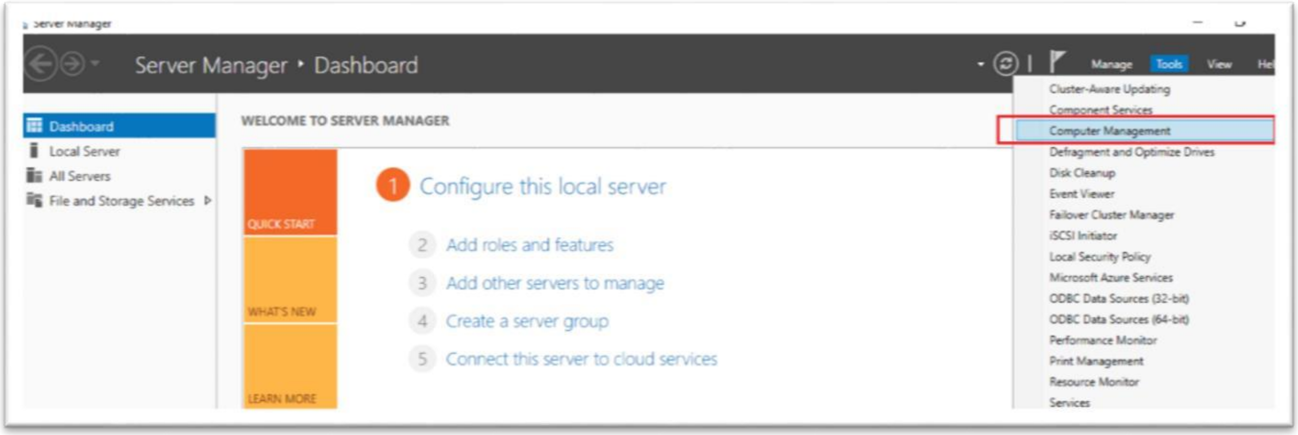
Configure Administrator permission, windows user and login for the service account

Once the Service account created on the Domain controller, we need to add service account as a member of the administrator account on both nodes.

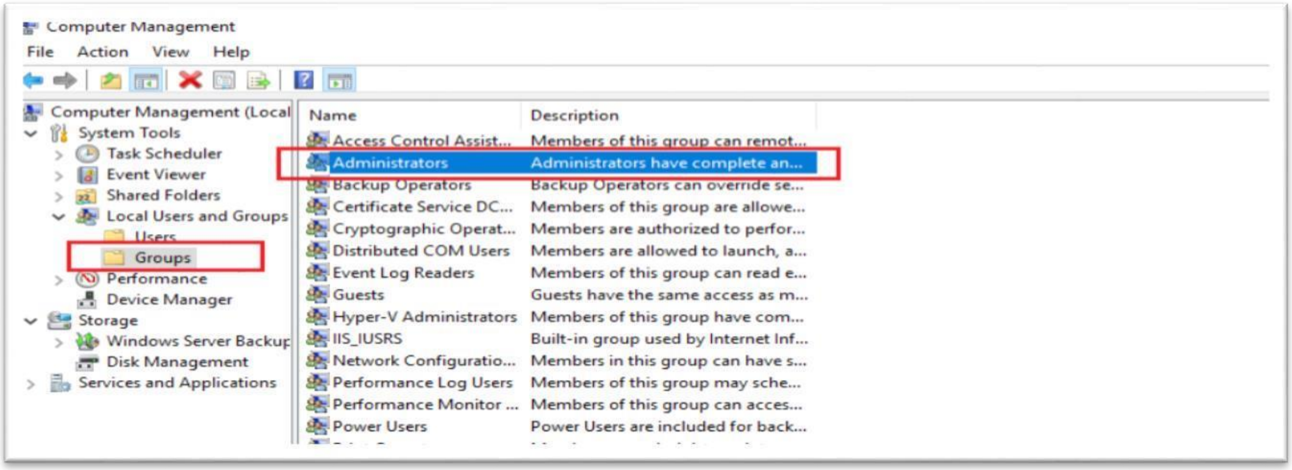
Connect to both node servers **FINPORTALDB** and **FINPORTALDB2** and perform below steps

- Add Service account as an Administrator
- Create a Windows user for the Service account
- Create a Windows authentication login for a service account login in the SQL database instance

Open **Server manager** and Select **Tools** and **Computer Management**

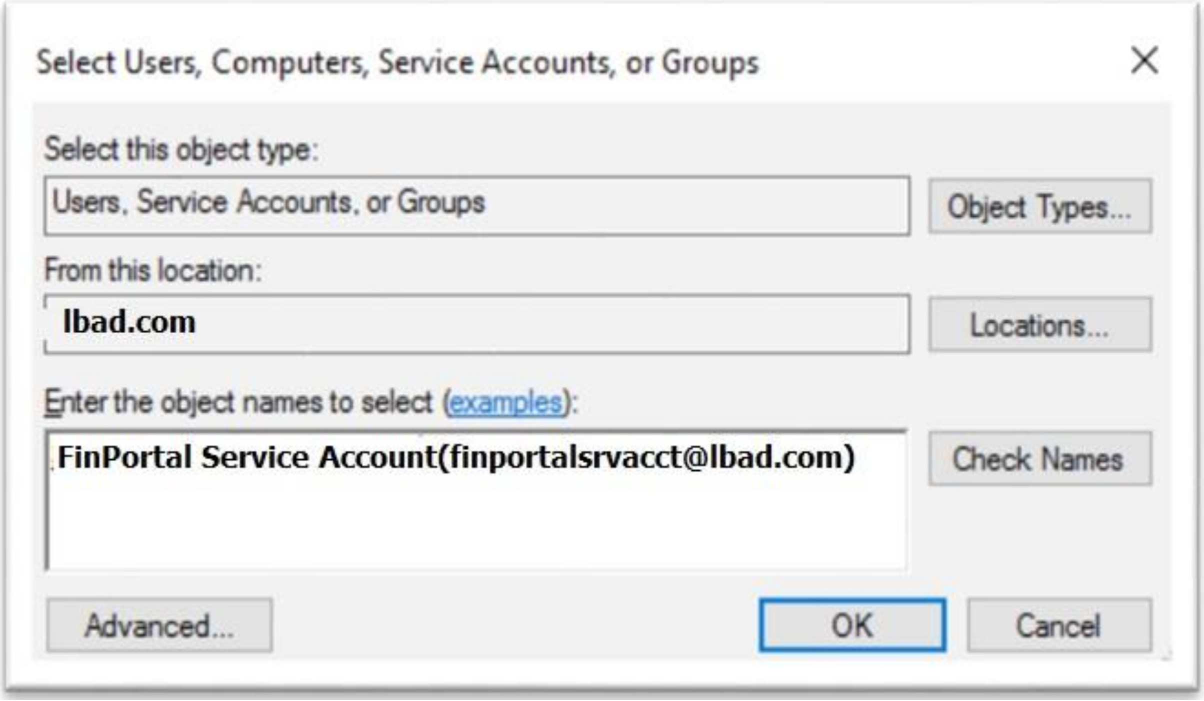


In **the Computer management window**, select **Groups** and Right-Click **Administrators** and Go to **Properties**



Name	Description
Access Control Assist...	Members of this group can remot...
Administrators	Administrators have complete an...
Backup Operators	Backup Operators can override se...
Certificate Service DC...	Members of this group are allowe...
Cryptographic Operat...	Members are authorized to perfor...
Distributed COM Users	Members are allowed to launch, a...
Event Log Readers	Members of this group can read e...
Guests	Guests have the same access as m...
Hyper-V Administrators	Members of this group have com...
IIS_IUSRS	Built-in group used by Internet Inf...
Network Configuratio...	Members in this group can have s...
Performance Log Users	Members of this group may sche...
Performance Monitor ...	Members of this group can acces...
Power Users	Power Users are included for back...

Add User, Enter the Service account login name and Check names and Click **OK**
Note – Once clicked on the Check Names, it may ask to enter username and password pop-up window. In the pop-up window, we need to register a domain controller username and password and make sure the location should select as a directory.

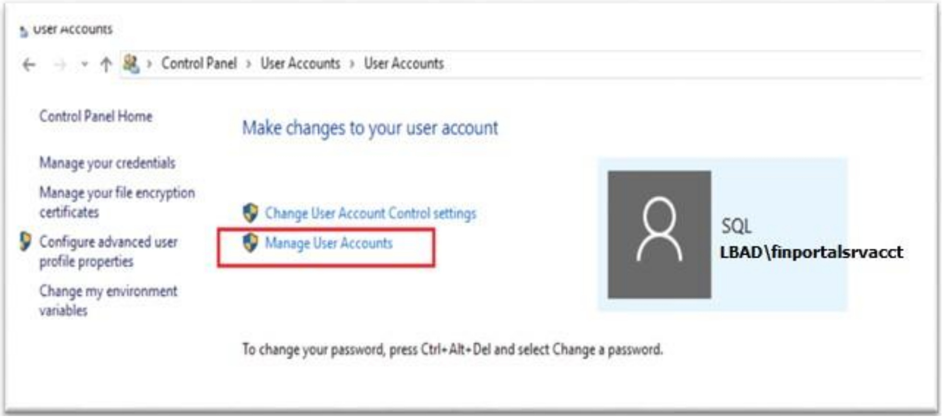


Select this object type:
Users, Service Accounts, or Groups

From this location:
lbad.com

Enter the object names to select (examples):
FinPortal Service Account(finportalsrvacct@lbad.com)

In the following Fig. We will create the Service account as a windows user in **Control Panel > User Account > Click on Manage User Accounts**. Enter a **Service account name** and **domain name** and Click **Next**, Select **Administrator** and Finish



User Accounts

Control Panel › User Accounts › User Accounts

Control Panel Home

Manage your credentials

Manage your file encryption certificates

Configure advanced user profile properties

Change my environment variables

Make changes to your user account

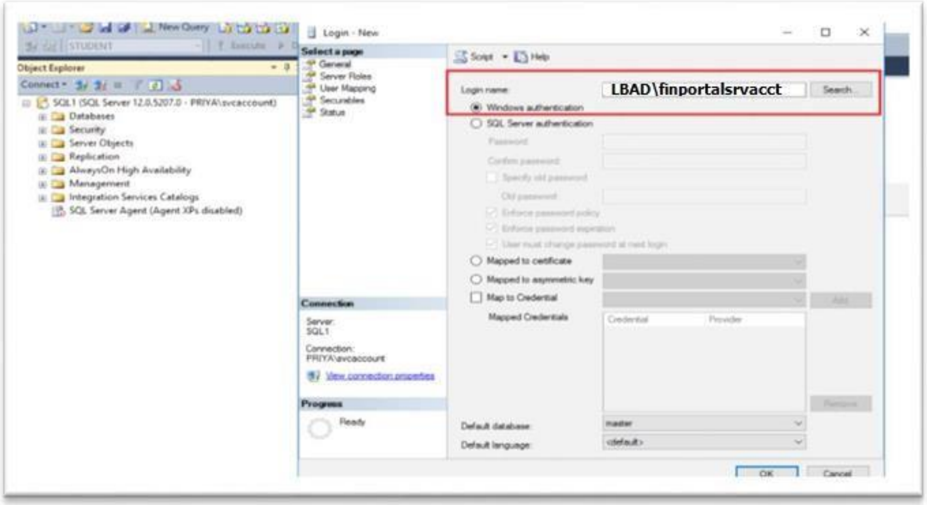
Change User Account Control settings

Manage User Accounts

SQL
LBAD\finportalsrvacct

To change your password, press Ctrl+Alt+Del and select Change a password.

Next, we will create a windows authentication login for the service account as shown in the following fig.



Login name: LBAD\finportalsrvacct

● Windows authentication

○ SQL Server authentication

Password

Confirm password

□ Specify old password

Old password

☑ Enforce password policy

☑ Enforce password expiration

☑ User must change password at next login

○ Mapped to certificate

○ Mapped to asymmetric key

□ Map to Credential

Mapped Credentials

Credential	Provider

Connection

Server:
SQL1

Connection:
PRIYA\svcaccount

View connection properties

Progress

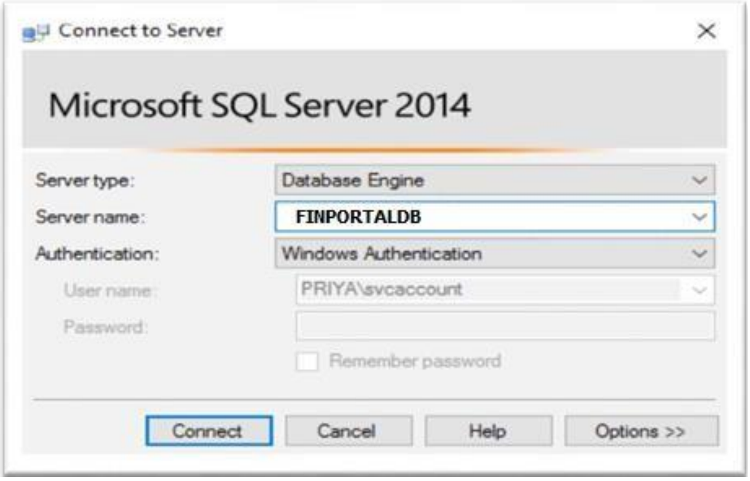
Ready

Default database: master

Default language: <default>

Take remote desktop connection of SQL1 with the service account windows user, connect to the SQL Server database engine instance SQL1 with default windows authentication login as shown in the following fig.

Enable AlwaysOn Feature



Connect to Server

Microsoft SQL Server 2014

Server type: Database Engine

Server name: FINPORTALDB

Authentication: Windows Authentication

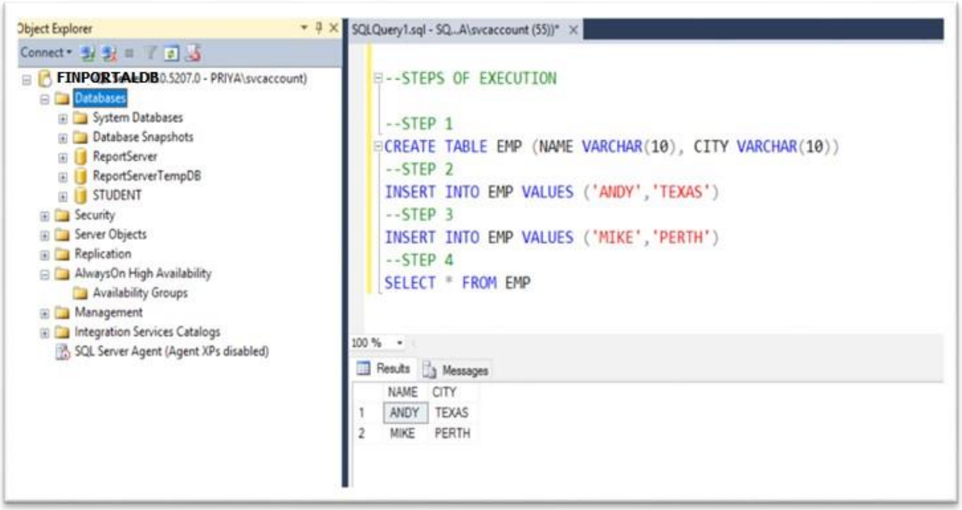
User name: PRIYA\svcaccount

Password:

□ Remember password

Once SQL Server instance is connected, we need to decide database which will take part in SQL Server AlwaysOn High Availability.

In this demonstration, we will create a new database **STUDENT**, and then we will create a table and add a few records into it as shown in the following fig.



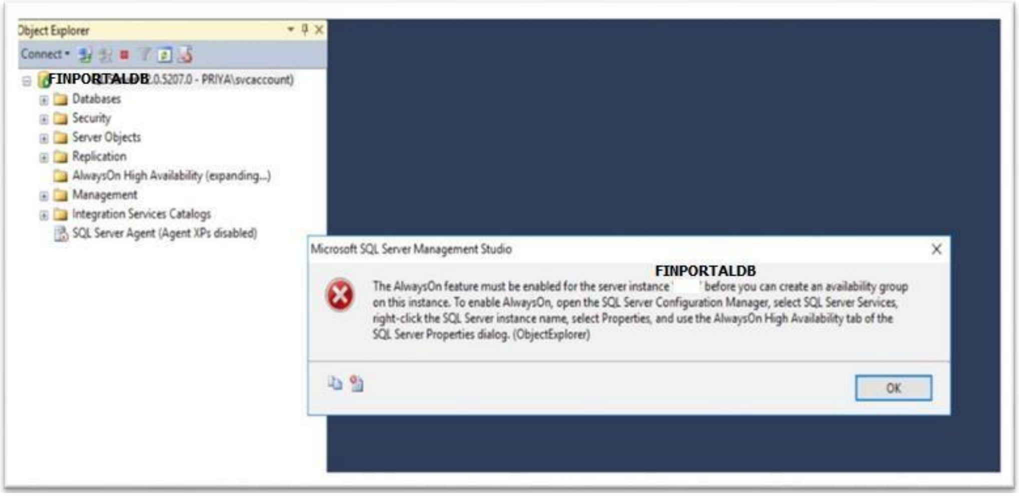
```
--STEPS OF EXECUTION

--STEP 1
CREATE TABLE EMP (NAME VARCHAR(10), CITY VARCHAR(10))
--STEP 2
INSERT INTO EMP VALUES ('ANDY','TEXAS')
--STEP 3
INSERT INTO EMP VALUES ('MIKE','PERTH')
--STEP 4
SELECT * FROM EMP
```

```
   NAME  CITY
1  ANDY  TEXAS
2  MIKE  PERTH
```

Next, Expand SQL Server AlwaysOn High Availability option, we will get an error while expanding the AlwaysOn option

The AlwaysOn feature must be enabled for the server instance 'SQL1' before you can create an availability group on this instance. To enable AlwaysOn, open the SQL Server Configuration Manager, select SQL Server Services, right-click the SQL Server instance name, select Properties, and use the AlwaysOn High Availability tab of the SQL Server Properties dialog. (ObjectExplorer)

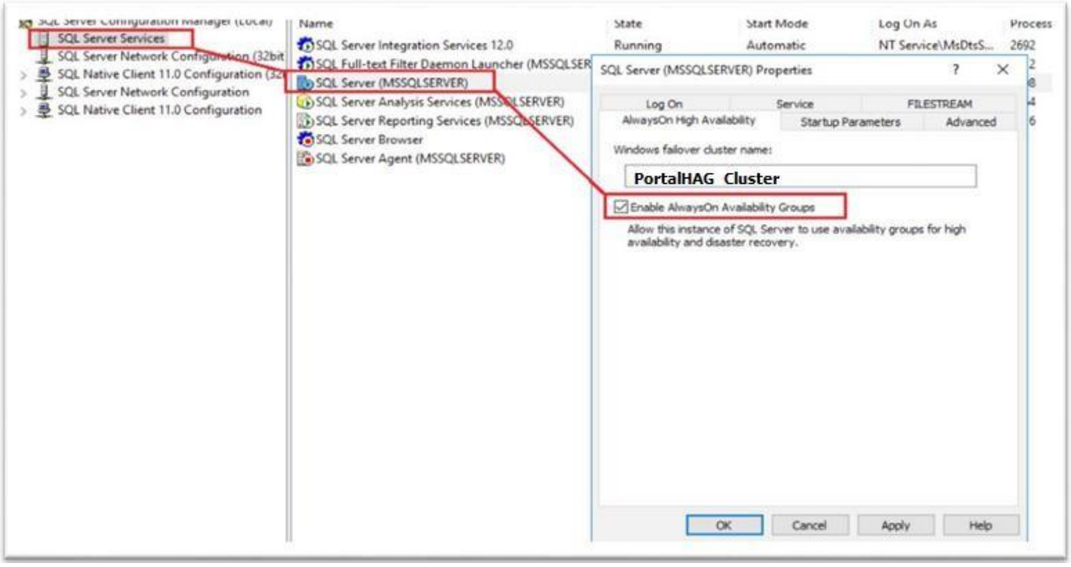

Object Explorer
Connect ▾
FINPORTALDB 0.5207.0 - PRIYA\svcaccount)
Databases
Security
Server Objects
Replication
AlwaysOn High Availability (expanding...)
Management
Integration Services Catalogs
SQL Server Agent (Agent XPs disabled)
Microsoft SQL Server Management Studio
OK

FINPORTALDB

The AlwaysOn feature must be enabled for the server instance '   ' before you can create an availability group on this instance. To enable AlwaysOn, open the SQL Server Configuration Manager, select SQL Server Services, right-click the SQL Server instance name, select Properties, and use the AlwaysOn High Availability tab of the SQL Server Properties dialog. (ObjectExplorer)

To enable AlwaysOn feature, **Open SQL Server Configuration Manager**, **Right-click SQL Server instance** and **go to properties**, Select **AlwaysOn High Availability tab section** and tick checkbox for **Enable AlwaysOn AvailabilityGroups**

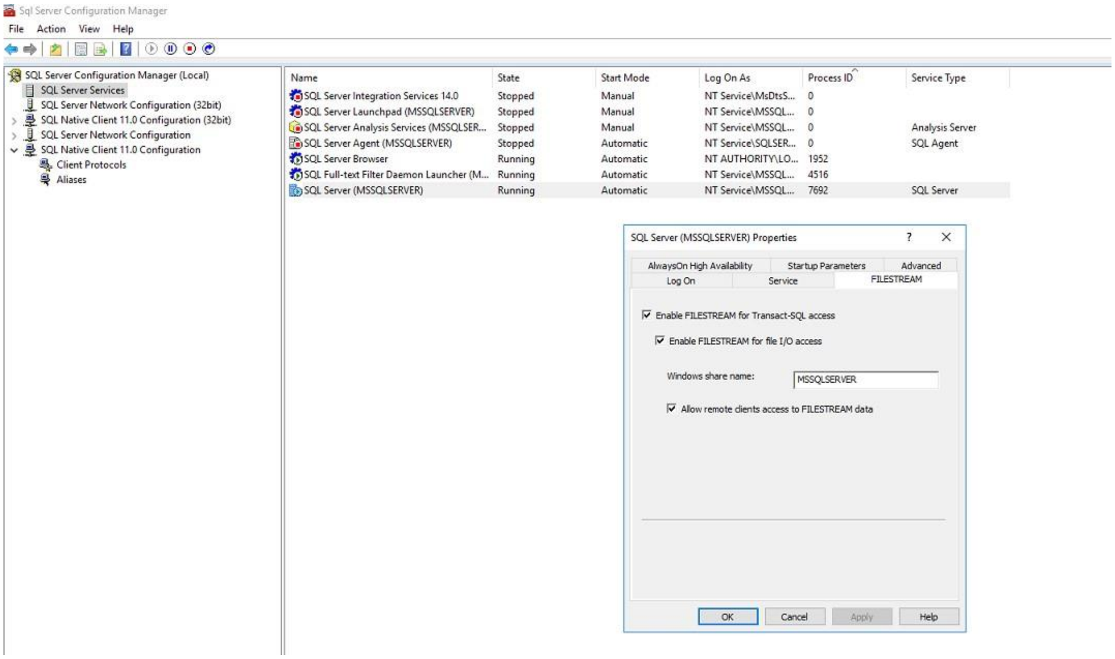
Note: – *We also need to make sure nodes where we will enable AlwaysOn feature is part of Windows Failover Cluster.*


SQL Server Configuration Manager (Local)
SQL Server Services
SQL Server Network Configuration (32bit)
SQL Native Client 11.0 Configuration (32
SQL Server Network Configuration
SQL Native Client 11.0 Configuration
Name
State
Start Mode
Log On As
Process
SQL Server Integration Services 12.0
Running
Automatic
NT Service\MsDtsS...
2692
SQL Full-text Filter Daemon Launcher (MSSQLSER
SQL Server (MSSQLSERVER)
SQL Server Analysis Services (MSSQLSERVER)
SQL Server Reporting Services (MSSQLSERVER)
SQL Server Browser
SQL Server Agent (MSSQLSERVER)
SQL Server (MSSQLSERVER) Properties
Log On
Service
FILESTREAM
AlwaysOn High Availability
Startup Parameters
Advanced
OK
Cancel
Apply
Help

Windows failover cluster name: PortalHAG Cluster

☑ Enable AlwaysOn Availability Groups

Allow this instance of SQL Server to use availability groups for high availability and disaster recovery.


Sql Server Configuration Manager
File
Action
View
Help
SQL Server Configuration Manager (Local)
SQL Server Services
SQL Server Network Configuration (32bit)
SQL Native Client 11.0 Configuration (32bit)
SQL Server Network Configuration
SQL Native Client 11.0 Configuration
Client Protocols
Aliases
SQL Server (MSSQLSERVER) Properties
AlwaysOn High Availability
Startup Parameters
Advanced
Log On
Service
FILESTREAM
OK
Cancel
Apply
Help

Name	State	Start Mode	Log On As	Process ID	Service Type
SQL Server Integration Services 14.0	Stopped	Manual	NT Service\MsDtsS...	0	
SQL Server Launchpad (MSSQLSERVER)	Stopped	Manual	NT Service\MSSQL...	0	
SQL Server Analysis Services (MSSQLSER...	Stopped	Manual	NT Service\MSSQL...	0	Analysis Server
SQL Server Agent (MSSQLSERVER)	Stopped	Automatic	NT Service\SQLSER...	0	SQL Agent
SQL Server Browser	Running	Automatic	NT AUTHORITY\LO...	1952	
SQL Full-text Filter Daemon Launcher (M...	Running	Automatic	NT Service\MSSQL...	4516	
SQL Server (MSSQLSERVER)	Running	Automatic	NT Service\MSSQL...	7692	SQL Server

☑ Enable FILESTREAM for Transact-SQL access

☑ Enable FILESTREAM for file I/O access

Windows share name: MSSQLSERVER

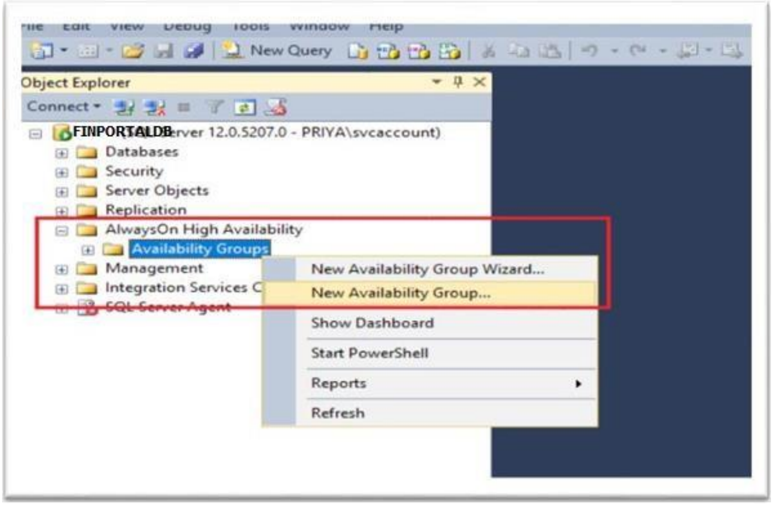
☑ Allow remote clients access to FILESTREAM data

Once we enabled, Apply and Click **OK**. Restart the SQL Server services.

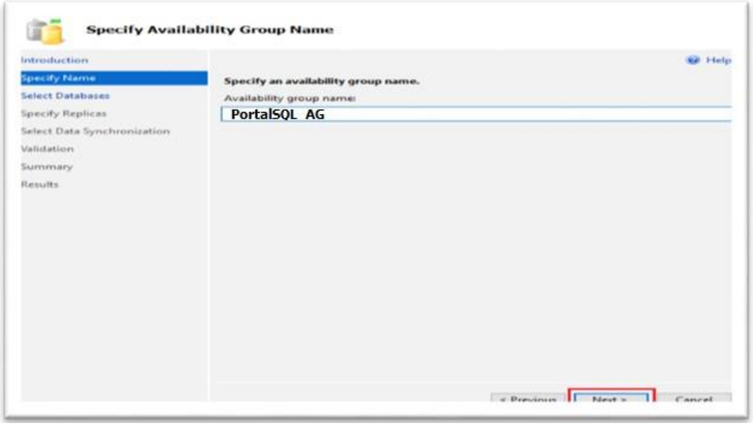
As shown in the following fig. we will able to use SQL Server AlwaysOn High Availability feature. Right click **Availability Groups** and Click **New Availability Group**.

Configuring Availability Group

An AlwaysOn Availability Group contains a set of user databases; we need to select user databases which will be part of the Availability group. These databases called as an Availability database.



Specify **Availability Group name** and click **Next**

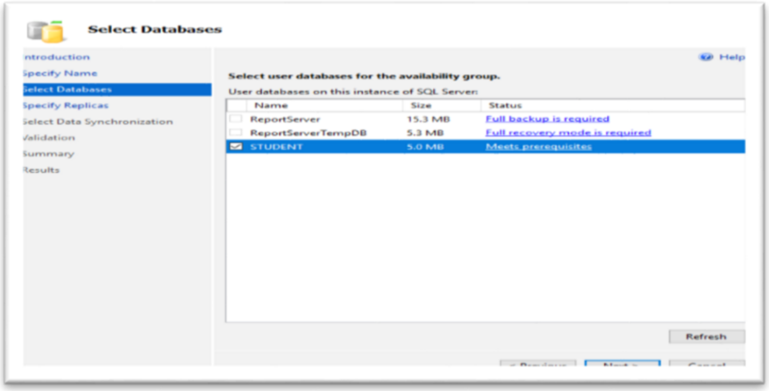


Specify Availability Group Name

Specify an availability group name.

Availability group name: PortalSQL AG

As shown in fig. we will use database **STUDENT**. To proceed further, we need to perform one essential prerequisite step, a Full backup of the database. So, take a Full backup of STUDENT and click **Next**



Select Databases

Select user databases for the availability group.

User databases on this instance of SQL Server:

	Name	Size	Status
□	ReportServer	15.3 MB	Full backup is required
□	ReportServerTempDB	5.3 MB	Full recovery mode is required
☑	STUDENT	5.0 MB	Meets prerequisites

Next, **Specify Replica** step has four sections. **Replica, Endpoint, Backup Preferences, and Listener**

Replica– Replica is a server. There are one primary replica and multiple replicas. In SQL server 2012, it supports up to 4 secondary replicas, while in SQL Server 2014, it supports up to 8 replicas.

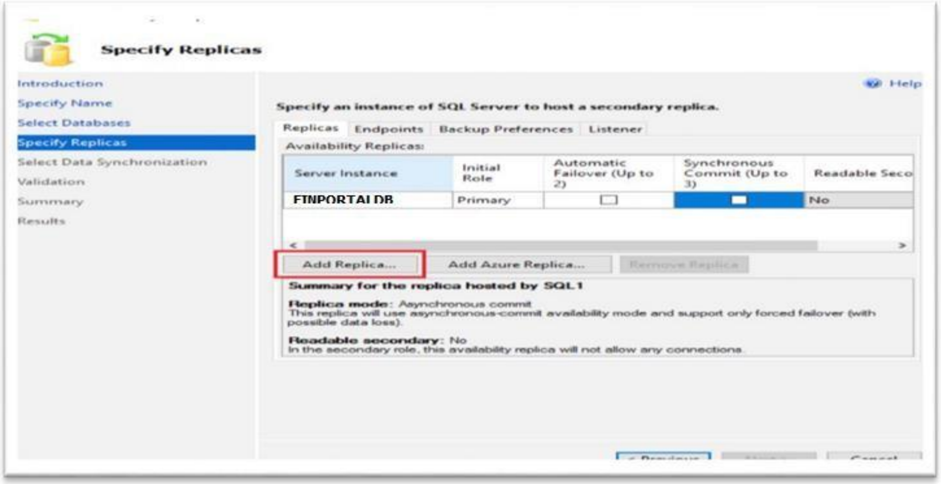
The primary replica is primary source server or production server. A secondary replica is a server which maintain a backup copy of the primary server availability database. On the Primary replica, it allows to perform Read and write operations while on the secondary replica only read operations.

In this case, SQL1 is our primary replica and SQL2 is a secondary replica. So, we will add SQL2 as a secondary replica as shown in the following fig.

Initial Role – It specifies the role of replica whether Primary or secondary**.**

Automatic Failover – It failovers functional role from primary replica to secondary replica by an automated method with no data loss.

Synchronous Commit – In the Synchronous-commit mode, failover can happen by either Automatic or manual way with no data loss. So, in this case, we will use synchronous commit with automatic failover.



Specify an instance of SQL Server to host a secondary replica.

Availability Replicas:

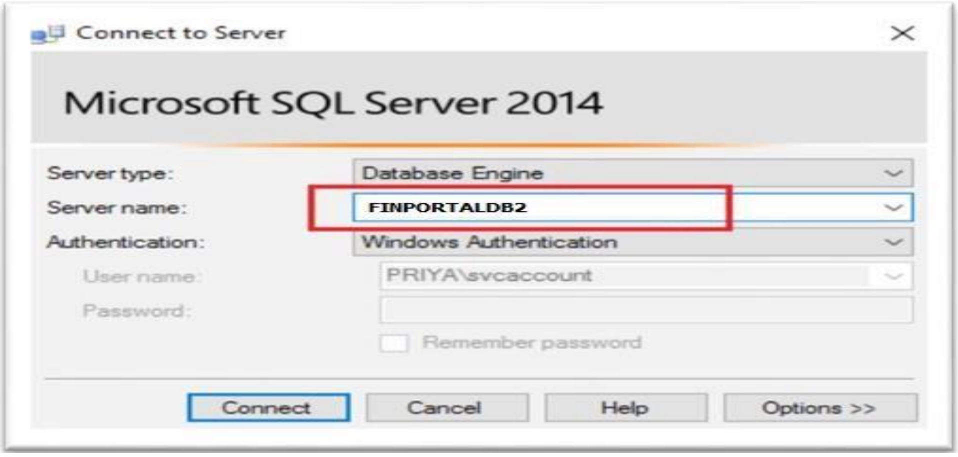
Server Instance	Initial Role	Automatic Failover (Up to 2)	Synchronous Commit (Up to 3)	Readable Seco
FINPORTALDB	Primary	□	□	No

Summary for the replica hosted by SQL1

Replica mode: Asynchronous commit
This replica will use asynchronous-commit availability mode and support only forced failover (with possible data loss).

Readable secondary: No
In the secondary role, this availability replica will not allow any connections.

Once clicked **Add Replica**, connect to the server, Select SQL2 and Connect



Server type: Database Engine

Server name: FINPORTALDB2

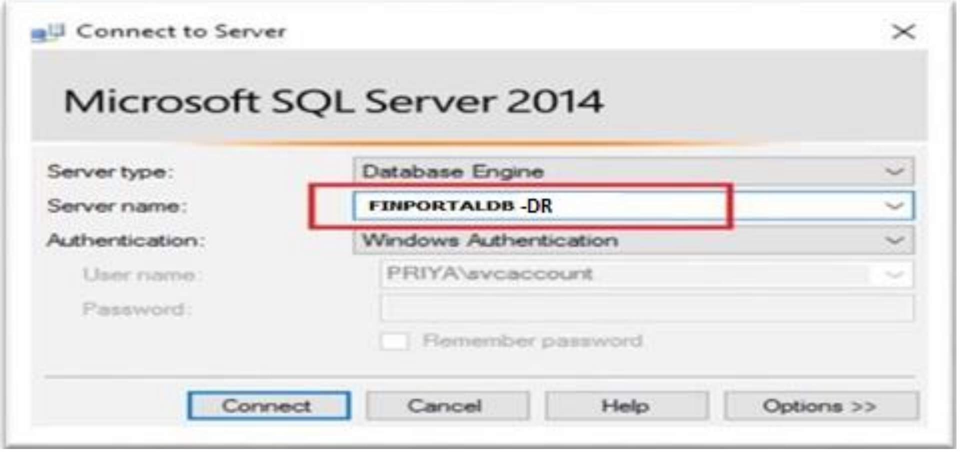
Authentication: Windows Authentication

User name: PRIYA\svcaccount

Password:

□ Remember password

Once we add secondary server SQL2 as a secondary replica, the primary role of SQL2 is secondary.



Connect to Server

Microsoft SQL Server 2014

Server type: Database Engine

Server name: FINPORTALDB -DR

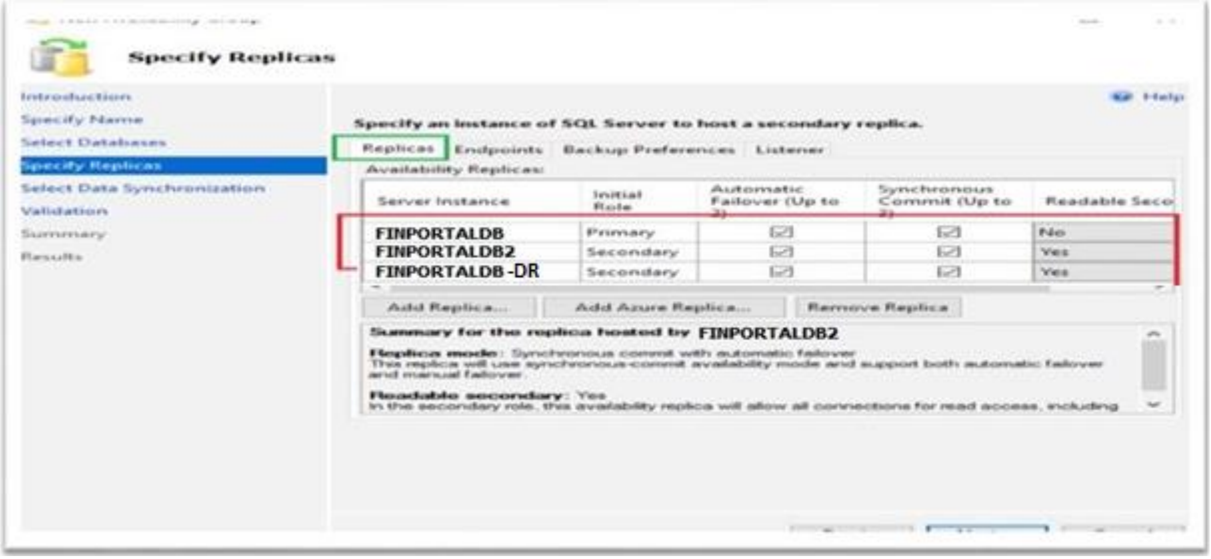
Authentication: Windows Authentication

User name: PRIYA\svcaccount

Password:

□ Remember password

Once we add secondary server SQL3 as a secondary replica, the primary role of SQL3 is secondary.



Specify Replicas

Specify an instance of SQL Server to host a secondary replica.

Availability Replicas:

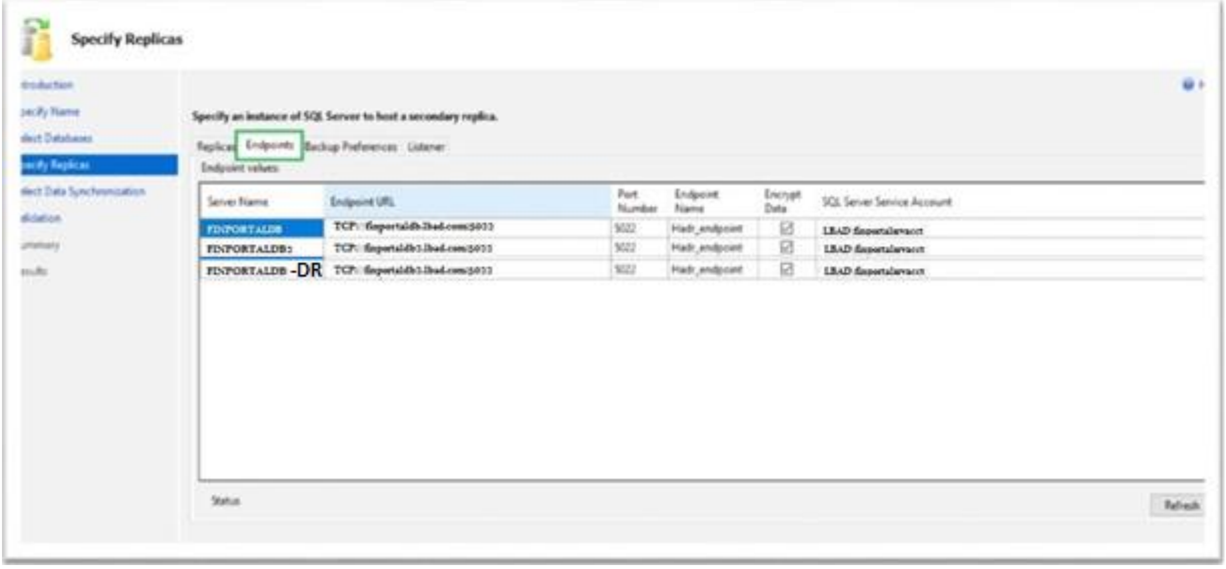
Server Instance	Initial Role	Automatic Failover (Up to 3)	Synchronous Commit (Up to 3)	Readable Seco
FINPORTALDB	Primary	☑	☑	No
FINPORTALDB2	Secondary	☑	☑	Yes
FINPORTALDB -DR	Secondary	☑	☑	Yes

Summary for the replica hosted by FINPORTALDB2

Replica mode: Synchronous commit with automatic failover
This replica will use synchronous-commit availability mode and support both automatic failover and manual failover.

Readable secondary: Yes
In the secondary role, this availability replica will allow all connections for read access, including

In the Endpoint section, it will show configured endpoint URL, port, endpoint name, and the service account name for SQL1, SQL2 and SQL3 nodes.



Specify Replicas

Specify an instance of SQL Server to host a secondary replica.

Endpoint values:

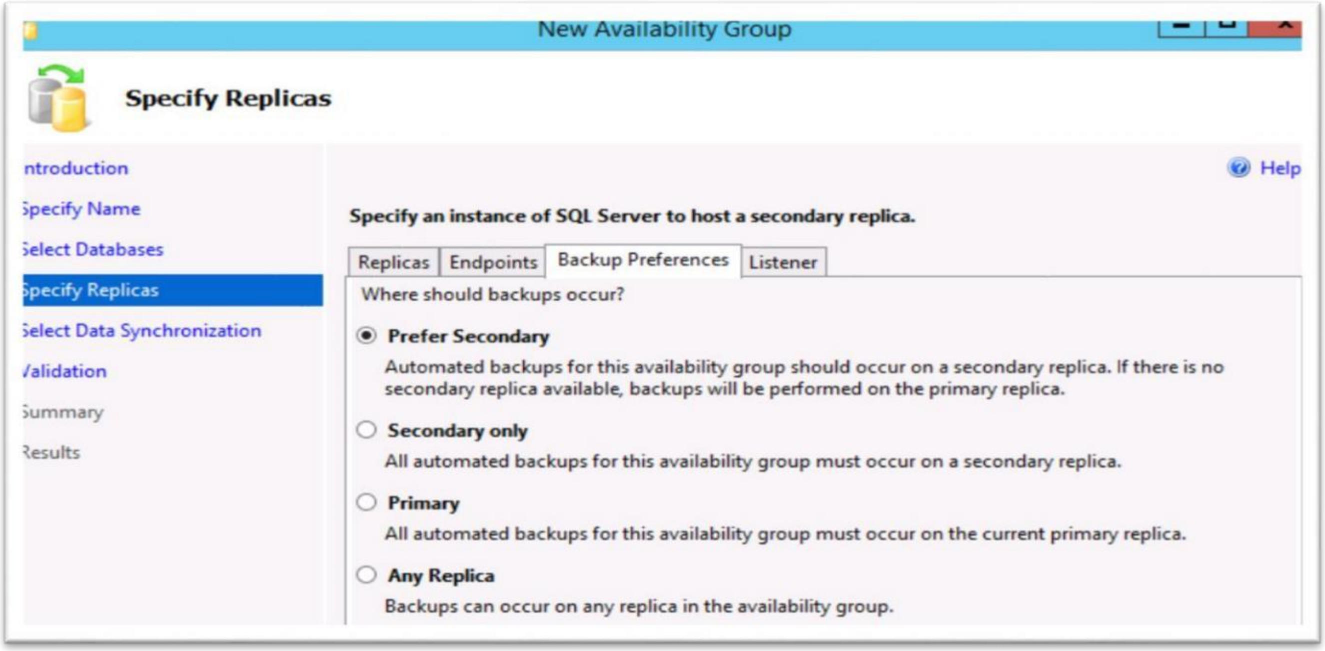
Server Name	Endpoint URL	Port Number	Endpoint Name	Encrypt Data	SQL Server Service Account
FINPORTALDB	TCP://finportaldb.lbad.com:5022	5022	Hadr_endpoint	☑	LBAD\finportalsvacct
FINPORTALDB2	TCP://finportaldb2.lbad.com:5022	5022	Hadr_endpoint	☑	LBAD\finportalsvacct
FINPORTALDB -DR	TCP://finportaldb3.lbad.com:5022	5022	Hadr_endpoint	☑	LBAD\finportalsvacct

Status

Backup Preferences – Backup preferences indicate the backup location of the **availability group.** It provides four backup options.

- **Prefer Secondary** – Automatic backup will occur on a secondary replica
- **Secondary only** – Automatic backup must occur on a secondary replica
- **Primary** – Automatic backup must occur on a primary replica
- **Any Replica** – Backup will occur on any replica

On the secondary replica, we can only take a log backup, and Copy-only backup, Differential, and Full back up are not allowed on a secondary replica. While on the primary replica, we can perform Full, log, and Differential backups.



Specify an instance of SQL Server to host a secondary replica.

Where should backups occur?

● **Prefer Secondary**

Automated backups for this availability group should occur on a secondary replica. If there is no secondary replica available, backups will be performed on the primary replica.

○ **Secondary only**

All automated backups for this availability group must occur on a secondary replica.

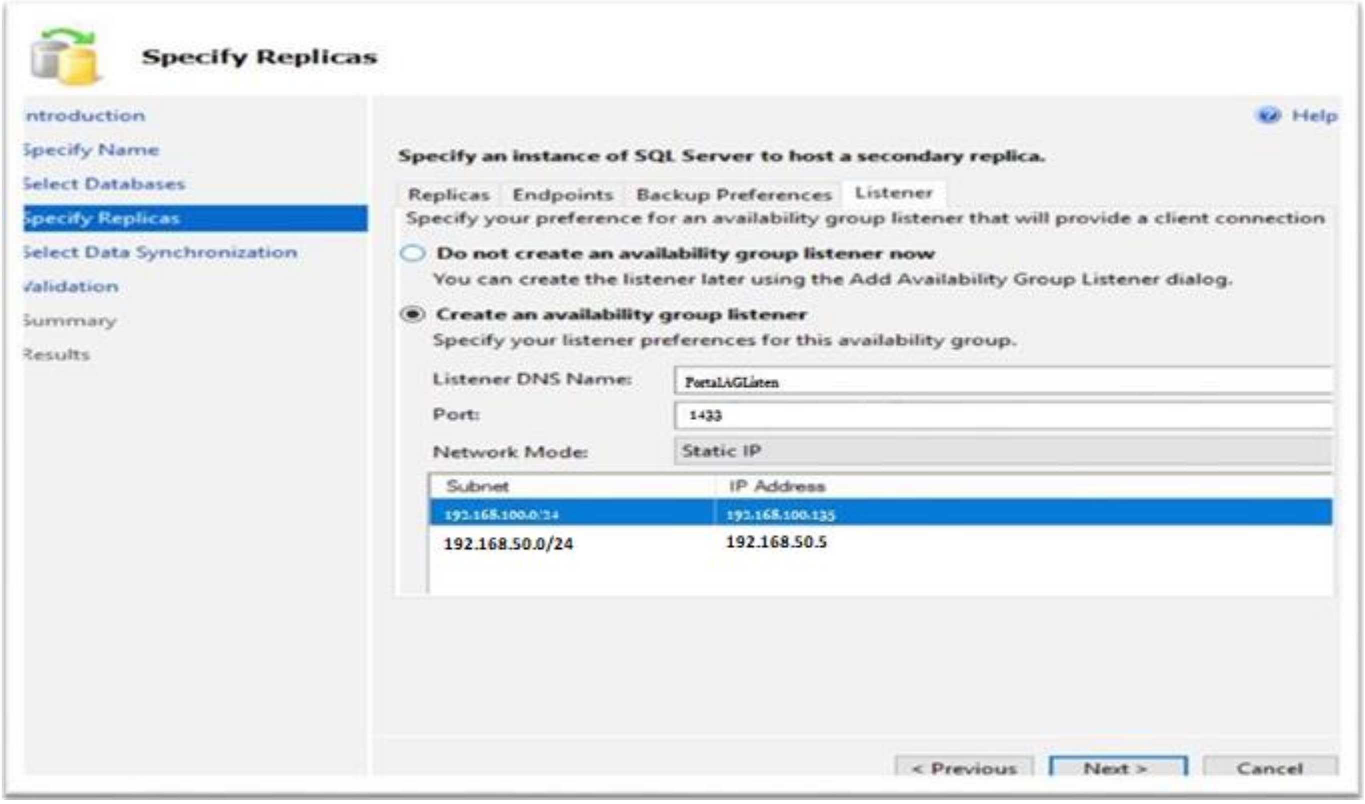
○ **Primary**

All automated backups for this availability group must occur on the current primary replica.

○ **Any Replica**

Backups can occur on any replica in the availability group.

Listener– Listener is a server through which nodes get to communicate with each other. The Listener has all information about availability group. We need to select **Create an Availability group listener** option and specify Name, Port and static IP as shown in the following fig.



Specify Replicas

Specify an instance of SQL Server to host a secondary replica.

Specify your preference for an availability group listener that will provide a client connection

○ **Do not create an availability group listener now**
You can create the listener later using the Add Availability Group Listener dialog.

● **Create an availability group listener**
Specify your listener preferences for this availability group.

Listener DNS Name: PortalAGListen
Port: 1433
Network Mode: Static IP

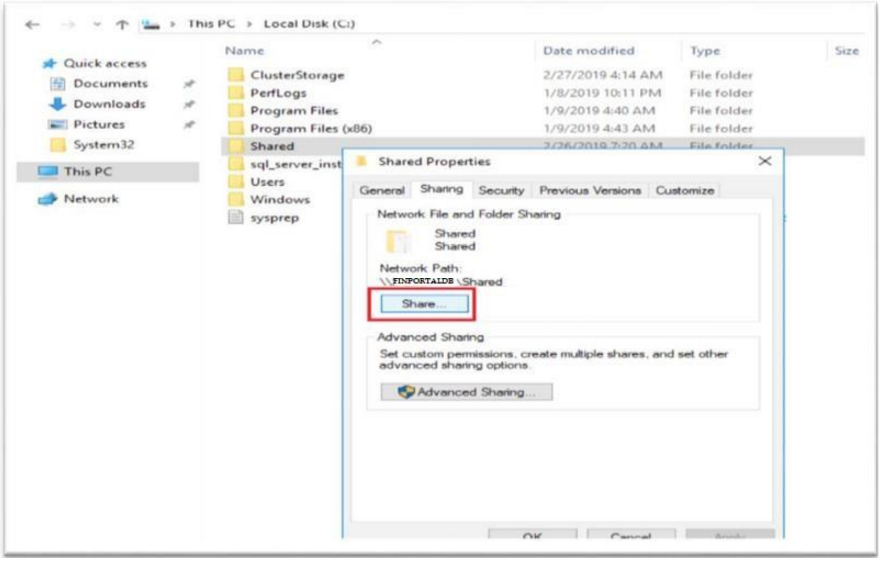
Subnet	IP Address
192.168.100.0/24	192.168.100.135
192.168.50.0/24	192.168.50.5

In **Data Synchronization step**, Select **Full** where it performs Full and Log backup and puts it into shared location path.

Create a Shared location

Connect to node SQL1 and choose desired drive location and folder, **Right-click folder** and **Go to Properties**, **Select Security** and click **Share**. It will show a pop-up window to add a user to whom, share permission need to grant.

Provide the service account name and Click **Add**; it will show pop-up window to check names, once service account name found in the domain name, click **Share**.



Name	Date modified	Type
ClusterStorage	2/27/2019 4:14 AM	File folder
PerfLogs	1/8/2019 10:11 PM	File folder
Program Files	1/9/2019 4:40 AM	File folder
Program Files (x86)	1/9/2019 4:43 AM	File folder
Shared	2/26/2019 7:20 AM	File folder
sql_server_inst		
Users		
Windows		
sysprep		

Shared Properties

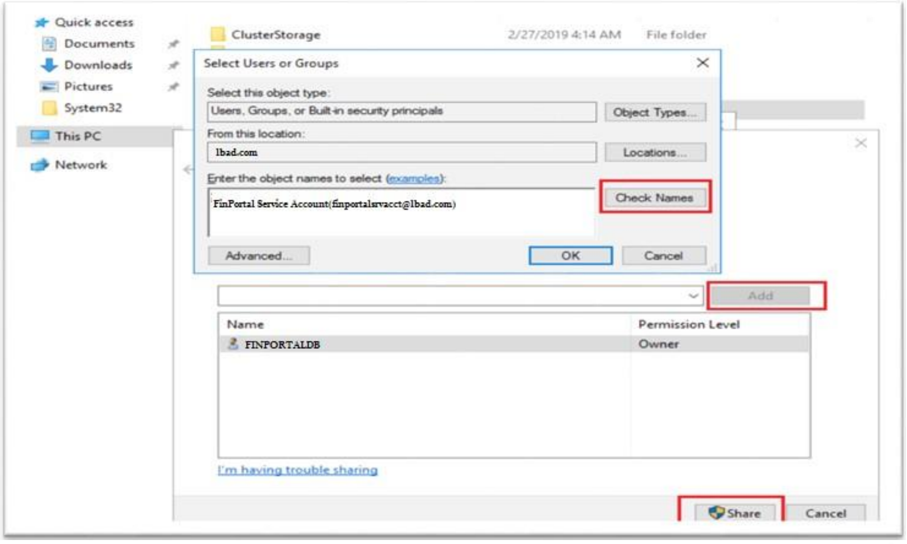
Network File and Folder Sharing

Shared
Shared

Network Path:
\\FINPORTALDB \Shared

Advanced Sharing

Set custom permissions, create multiple shares, and set other advanced sharing options.



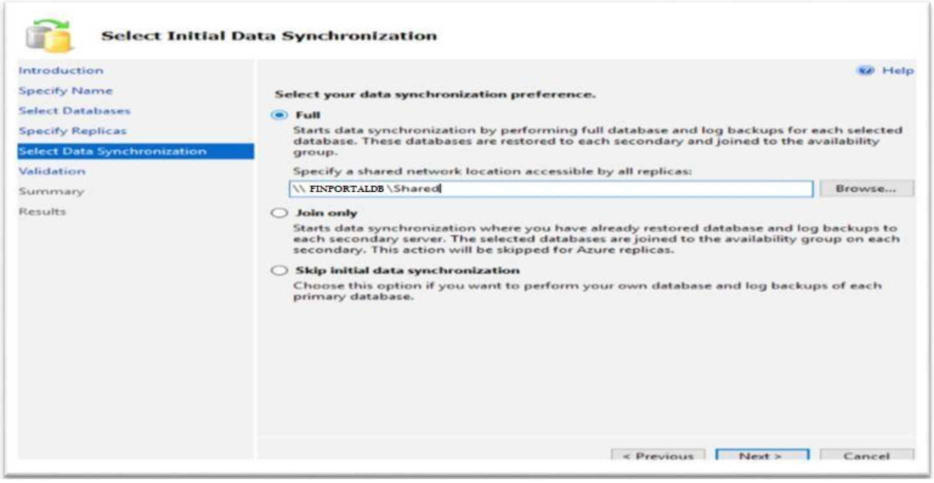
Select Users or Groups

Select this object type:
Users, Groups, or Built-in security principals

From this location:
lbad.com

Enter the object names to select (examples):
FinPortal Service Account(finportalsrvacct@lbad.com)

Name	Permission Level
FINPORTALDB	Owner



Select Initial Data Synchronization

Select your data synchronization preference.

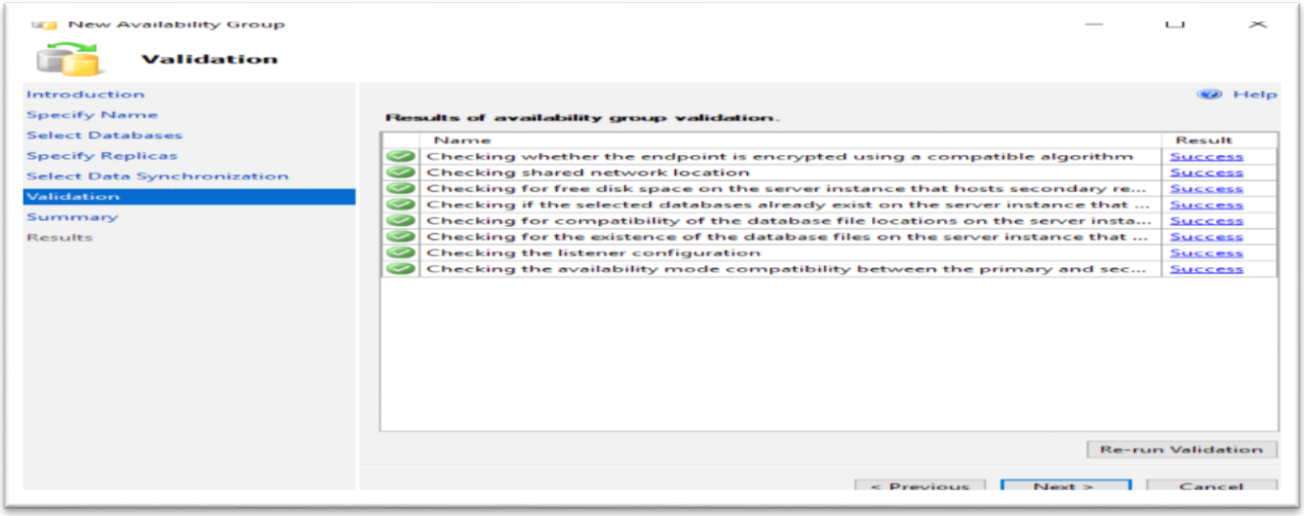
● Full
Starts data synchronization by performing full database and log backups for each selected database. These databases are restored to each secondary and joined to the availability group.

Specify a shared network location accessible by all replicas:
\\ FINPORTALDB \Shared

○ Join only
Starts data synchronization where you have already restored database and log backups to each secondary server. The selected databases are joined to the availability group on each secondary. This action will be skipped for Azure replicas.

○ Skip initial data synchronization
Choose this option if you want to perform your own database and log backups of each primary database.

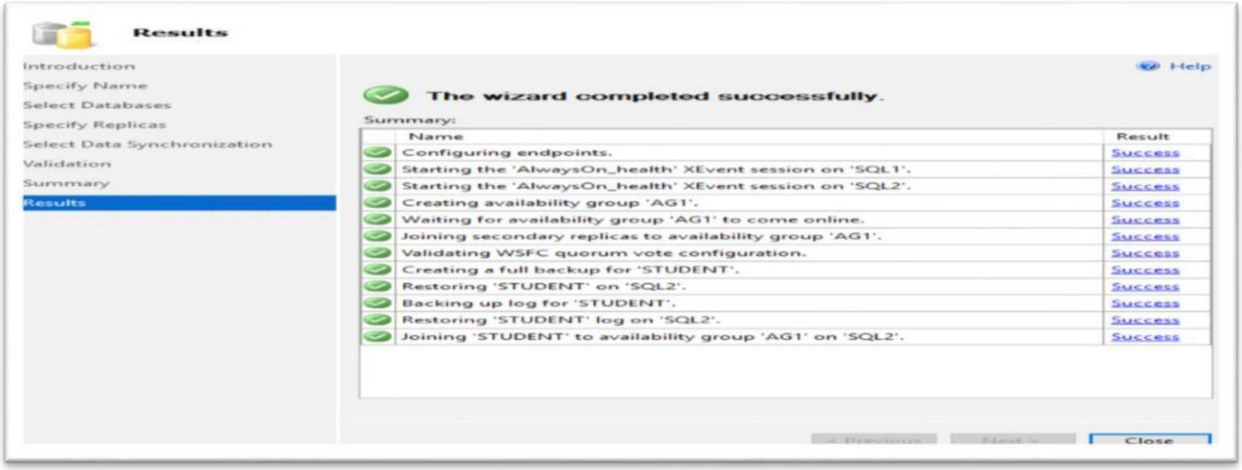
In **the Validation step**, SQL Server performs validations against any required actions, and it will provide warning or error messages for missing required steps.



Results of availability group validation.

	Name	Result
✓	Checking whether the endpoint is encrypted using a compatible algorithm	Success
✓	Checking shared network location	Success
✓	Checking for free disk space on the server instance that hosts secondary re...	Success
✓	Checking if the selected databases already exist on the server instance that ...	Success
✓	Checking for compatibility of the database file locations on the server insta...	Success
✓	Checking for the existence of the database files on the server instance that ...	Success
✓	Checking the listener configuration	Success
✓	Checking the availability mode compatibility between the primary and sec...	Success

It performed all validation steps successfully, and wizard operation completed as shown in the following fig.

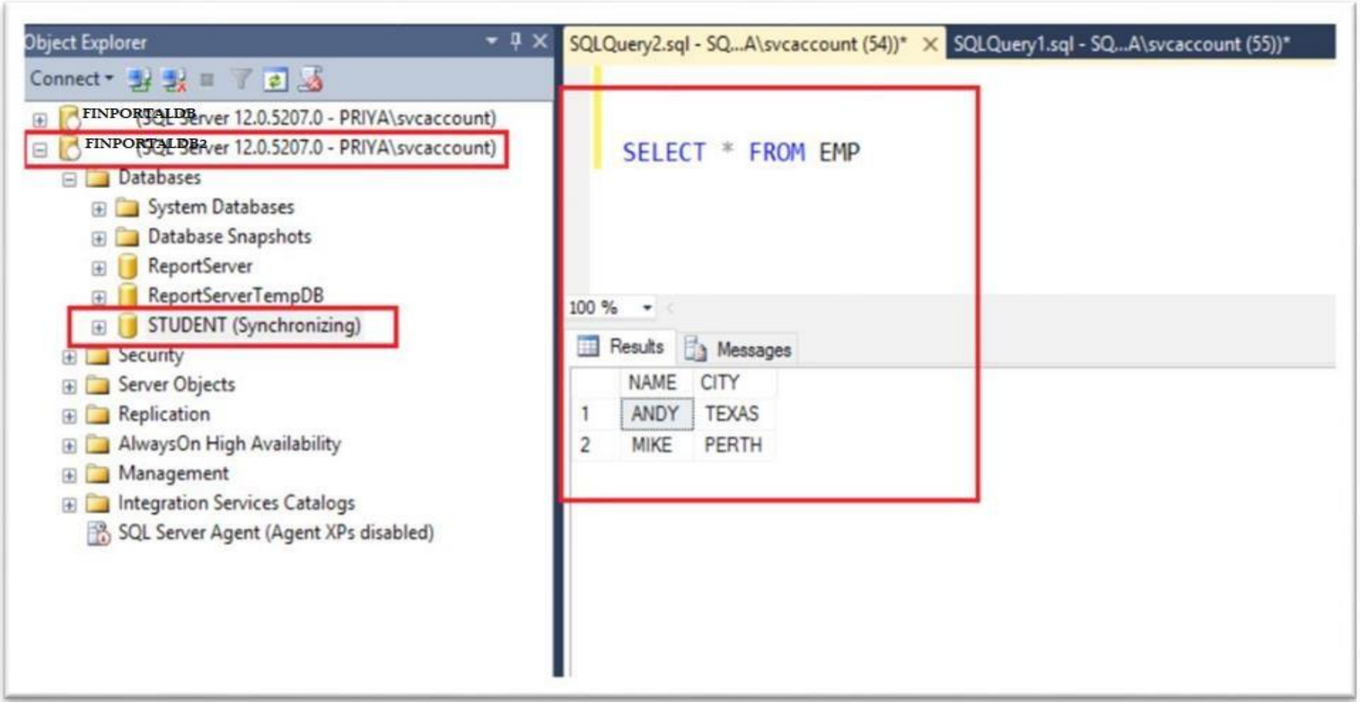


The wizard completed successfully.

Summary:

	Name	Result
✓	Configuring endpoints.	Success
✓	Starting the 'AlwaysOn_health' XEvent session on 'SQL1'.	Success
✓	Starting the 'AlwaysOn_health' XEvent session on 'SQL2'.	Success
✓	Creating availability group 'AG1'.	Success
✓	Waiting for availability group 'AG1' to come online.	Success
✓	Joining secondary replicas to availability group 'AG1'.	Success
✓	Validating WSFC quorum vote configuration.	Success
✓	Creating a full backup for 'STUDENT'.	Success
✓	Restoring 'STUDENT' on 'SQL2'.	Success
✓	Backing up log for 'STUDENT'.	Success
✓	Restoring 'STUDENT' log on 'SQL2'.	Success
✓	Joining 'STUDENT' to availability group 'AG1' on 'SQL2'.	Success

After successful completion, we will verify the database at secondary replica SQL2. As we can observe, Database STUDENT is in Synchronizing state, and it is in sync with the primary replica, and we can read data successfully.


Object Explorer
Connect
FINPORTALDB (SQL Server 12.0.5207.0 - PRIYA\svcaccount)
FINPORTALDB2 (SQL Server 12.0.5207.0 - PRIYA\svcaccount)
Databases
System Databases
Database Snapshots
ReportServer
ReportServerTempDB
STUDENT (Synchronizing)
Security
Server Objects
Replication
AlwaysOn High Availability
Management
Integration Services Catalogs
SQL Server Agent (Agent XPs disabled)
SQLQuery2.sql - SQ...A\svcaccount (54))*
SQLQuery1.sql - SQ...A\svcaccount (55))*
100 %
Results
Messages

```
SELECT * FROM EMP
```

	NAME	CITY
1	ANDY	TEXAS
2	MIKE	PERTH