

Tutorial: Configure replication between a server and mobile clients (merge)

- 04/03/2018
- 9 minutes to read
-

Applies to:  SQL Server (all supported versions)

Merge replication is a good solution to the problem of moving data between a central server and mobile clients that are only occasionally connected. By using the replication wizards, you can easily configure and administer a merge replication topology.

This tutorial shows you how to configure a replication topology for mobile clients. For more information about merge replication, see the [overview of merge replication](#).

What you will learn

This tutorial teaches you to use merge replication to publish data from a central database to one or more mobile users so that each user gets a uniquely filtered subset of the data.

In this tutorial, you will learn how to:

- Configure a publisher for merge replication.
- Add a mobile subscriber for merge publication.
- Synchronize the subscription to the merge publication.

Prerequisites

This tutorial is for users who are familiar with fundamental database operations, but who have limited experience with replication. Before you start this tutorial, you must complete [Tutorial: Prepare SQL Server for replication](#).

To complete this tutorial, you need SQL Server, SQL Server Management Studio (SSMS), and an AdventureWorks database:

- At the publisher server (source), install:
 - Any edition of SQL Server, except for SQL Server Express or SQL Server Compact. These editions cannot be a replication publisher.
 - The **AdventureWorks2012** sample database. To enhance security, the sample databases are not installed by default.

- At the subscriber server (destination), install any edition of SQL Server, except SQL Server Express or SQL Server Compact. The publication that's created in this tutorial does not support either SQL Server Express or SQL Server Compact.
- Install [SQL Server Management Studio](#).
- Install [SQL Server 2017 Developer edition](#).
- Download the [AdventureWorks sample database](#). For instructions on restoring a database in SSMS, see [Restoring a database](#).

Note

- Replication is not supported on SQL Server instances that are more than two versions apart. For more information, see [Supported SQL Server Versions in Replication Topology](#).
- In SQL Server Management Studio, you must connect to the publisher and subscriber by using a login that is a member of the **sysadmin** fixed server role. For more information on this role, see [Server-level roles](#).

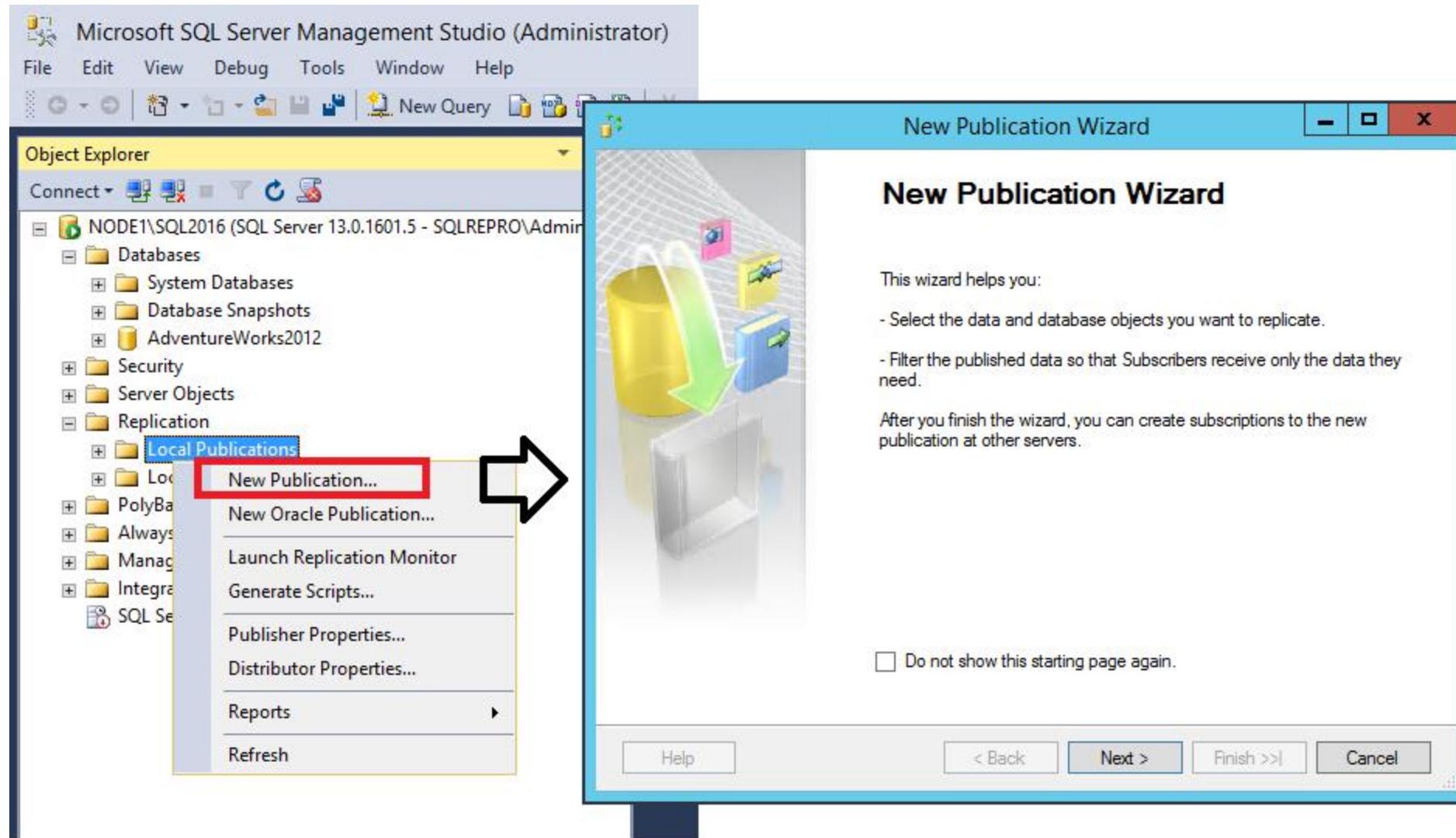
Estimated time to complete this tutorial: 60 minutes

Configure a publisher for merge replication

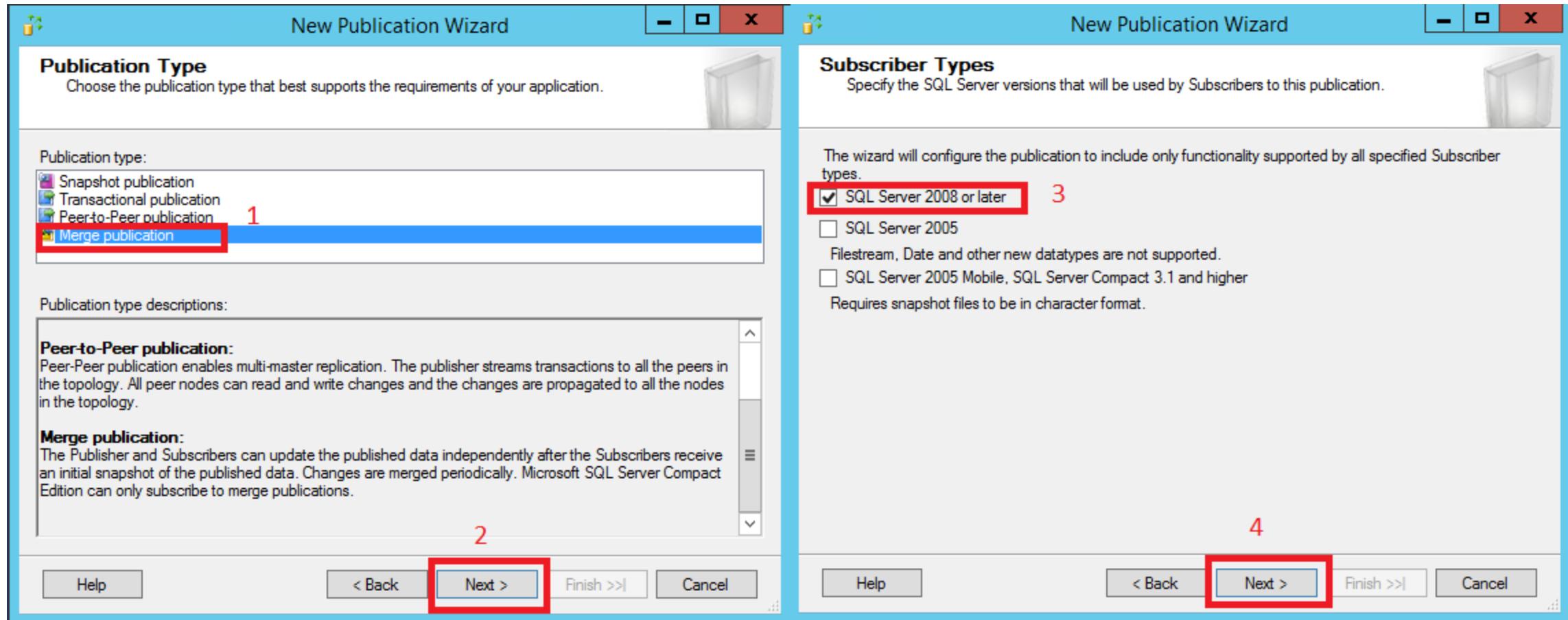
In this section, you create a merge publication by using SQL Server Management Studio to publish a subset of the **Employee**, **SalesOrderHeader**, and **SalesOrderDetail** tables in the **AdventureWorks2012** sample database. These tables are filtered with parameterized row filters so that each subscription contains a unique partition of the data. You also add the SQL Server login used by the Merge Agent to the publication access list (PAL).

Create merge publication and define articles

1. Connect to the publisher in SQL Server Management Studio, and then expand the server node.
2. Start the SQL Server Agent by right-clicking it in Object Explorer and selecting **Start**. If this step doesn't start the agent, you'll need to manually do so from SQL Server Configuration Manager.
3. Expand the **Replication** folder, right-click **Local Publications**, and select **New Publication**. The New Publication Wizard starts:



4. On the **Publication Database** page, select **AdventureWorks2012**, and then select **Next**.
5. On the **Publication Type** page, select **Merge publication**, and then select **Next**.
6. On the **Subscriber Types** page, ensure that only SQL Server 2008 or later is selected, and then select **Next**:



7. On the **Articles** page, expand the **Tables** node. Select the following three tables: **Employee**, **SalesOrderHeader**, and **SalesOrderDetail**. Select **Next**.

New Publication Wizard

Articles
Select tables and other objects to publish

Objects to publish:

- Tables **1**
- Stored Procedures
- Views
- Indexed Views
- User Defined Functions

New Publication Wizard

Articles
Select tables and other objects to publish as articles. S

Objects to publish:

- ProductPhoto (Production)
- ProductProductPhoto (Production)
- ProductReview (Production)
- ProductSubcategory (Production)
- ProductVendor (Purchasing)
- PurchaseOrderDetail (Purchasing)
- PurchaseOrderHeader (Purchasing)
- SalesOrderDetail (Sales) **2**
- SalesOrderHeader (Sales)
- SalesOrderHeaderSalesReason (Sales)
- SalesPerson (Sales)
- SalesPersonQuotaHistory (Sales)
- SalesReason (Sales)
- SalesTaxRate (Sales)
- SalesTerritory (Sales)
- SalesTerritoryHistory (Sales)
- ScrapReason (Production)
- Shift (HumanResources)
- ShipMethod (Purchasing)
- ShoppingCartItem (Sales)
- SpecialOffer (Sales)
- SpecialOfferProduct (Sales)
- StateProvince (Person)
- Store (Sales)
- TransactionHistory (Production)
- TransactionHistoryArchive (Production)
- UnitMeasure (Production)
- Vendor (Purchasing)
- WorkOrder (Production)

New Publication Wizard

Articles
Select tables and other objects to publish as articles. Select columns to filter tables.

Objects to publish:

- Employee (HumanResources) **3**
- Customer (Sales)
- DatabaseLog (dbo)
- Department (HumanResources)
- Document (Production)
- EmailAddress (Person)
- EmployeeDepartmentHistory (HumanResources)
- EmployeePayHistory (HumanResources)
- ErrorLog (dbo)
- Illustration (Production)
- JobCandidate (HumanResources)
- Location (Production)
- Password (Person)
- Person (Person)
- PersonCreditCard (Sales)
- PersonPhone (Person)
- PhoneNumberType (Person)
- Product (Production)
- ProductCategory (Production)
- ProductCostHistory (Production)
- ProductDescription (Production)
- ProductDocument (Production)
- ProductInventory (Production)
- ProductListPriceHistory (Production)
- ProductModel (Production)

Article Properties

- Highlighted table is download-only
- Show only checked articles in the list

4

5 The table that you selected includes one or more columns of type hierarchyid. Publishing this table for bidirectional replication could result in data loss for the hierarchyid column if rows are inserted, updated, or deleted at both the Publisher and Subscriber or at more than one Subscriber.

Help < Back **Next >** Finish >> Cancel

Note

The **Employee** table contains a column (**OrganizationNode**) that has the **hierarchyid** data type. This data type is supported for replication only in SQL Server 2017.

If you're using a build earlier than SQL Server 2017, a message appears at the bottom of the screen to notify you of potential data loss for using this column in bidirectional replication. For the purpose of this tutorial, you can ignore this message. However, this data type should not be replicated in a production environment unless you're using the supported build.

For more information about replicating the **hierarchyid** data type, see [Using hierarchyid columns in replication](#).

8. On the **Filter Table Rows** page, select **Add** and then select **Add Filter**.
9. In the **Add Filter** dialog box, select **Employee (HumanResources)** in **Select the table to filter**. Select the **LoginID** column, select the right arrow to add the column to the WHERE clause of the filter query, and modify the WHERE clause as follows:

SQLCopy

```
WHERE [LoginID] = HOST_NAME()
```

Select **A row from this table will go to only one subscription**, and select **OK**.

New Publication Wizard

Filter Table Rows

Add filters to published tables. Extend the filters to other tables by adding joins.

Filtered Tables:
Click Next if you do not need to filter the data in your publication.
Click Add to begin filtering your publication.

Add

Add Filter... 1

Add Join to Extend the Selected Filter...

Automatically Generate Filters

Add Filter

1. Select the table to filter.
Employee (HumanResources) 2

2. Complete the filter statement to identify which table rows Subscribers will receive. [Example statements](#)

Columns:

- BusinessEntityID (int)
- NationalIDNumber (nvarchar)
- LoginID (nvarchar) 3
- JobTitle (nvarchar)
- BirthDate (date)
- MaritalStatus (nchar)
- Gender (nchar)
- HireDate (date)
- rowguid (uniqueidentifier)

> 4

Filter statement:
`SELECT <published_columns> FROM [HumanResources].[Employee] WHERE [LoginID] = HOST_NAME()`

3. Specify how many subscriptions will receive data from this table.

A row from this table will go to multiple subscriptions

A row from this table will go to only one subscription 5

6 OK Cancel Help

10. On the **Filter Table Rows** page, select **Employee (Human Resources)**, select **Add**, and then select **Add Join to Extend the Selected Filter**.

a. In the **Add Join** dialog box, select **Sales.SalesOrderHeader** under **Joined table**. Select **Write the join statement manually**, and complete the join statement as follows:

SQLCopy

```
ON [Employee].[BusinessEntityID] = [SalesOrderHeader].[SalesPersonID]
```

b. In **Specify join options**, select **Unique key**, and then select **OK**.

New Publication Wizard

Filter Table Rows

Add filters to published tables. Extend the filters to other tables by adding joins.

Filtered Tables:

Employee (HumanResources) 1

Add

Add Join

Follow the steps to complete the join statement that defines the relationship between rows in the filtered and joined tables.

1. Verify filtered table and select the joined table:
Filtered table: Employee (HumanResources) 3
Joined table: [Sales].[SalesOrderHeader]
2. Create the join statement. [Examples](#)
 Use the builder to create the statement
 Write the join statement manually 4
Filtered table columns:
BusinessEntityID (int)
NationalIDNumber (nvarchar)
LoginID (nvarchar)
JobTitle (nvarchar)
BirthDate (date)
MaritalStatus (nchar)
Gender (nchar)
HireDate (date)
rowguid (uniqueidentifier)
Joined table columns:
OrderDate (datetime)
DueDate (datetime)
ShipDate (datetime)
Status (tinyint)
OnlineOrderFlag (Flag)
SalesOrderNumber (nvarchar)
PurchaseOrderNumber (OrderNum
AccountNumber (AccountNumber
CustomerID (int)
SalesPersonID (int)
Join statement:

```
SELECT <published_columns> FROM [HumanResources].[Employee] INNER JOIN [Sales].[SalesOrderHeader] ON [Employee].[BusinessEntityID] = [SalesOrderHeader].[SalesPersonID]
```
3. Specify join options:

Add Filter... 2
Add Join to Extend the Selected Filter...
Automatically Generate Filters

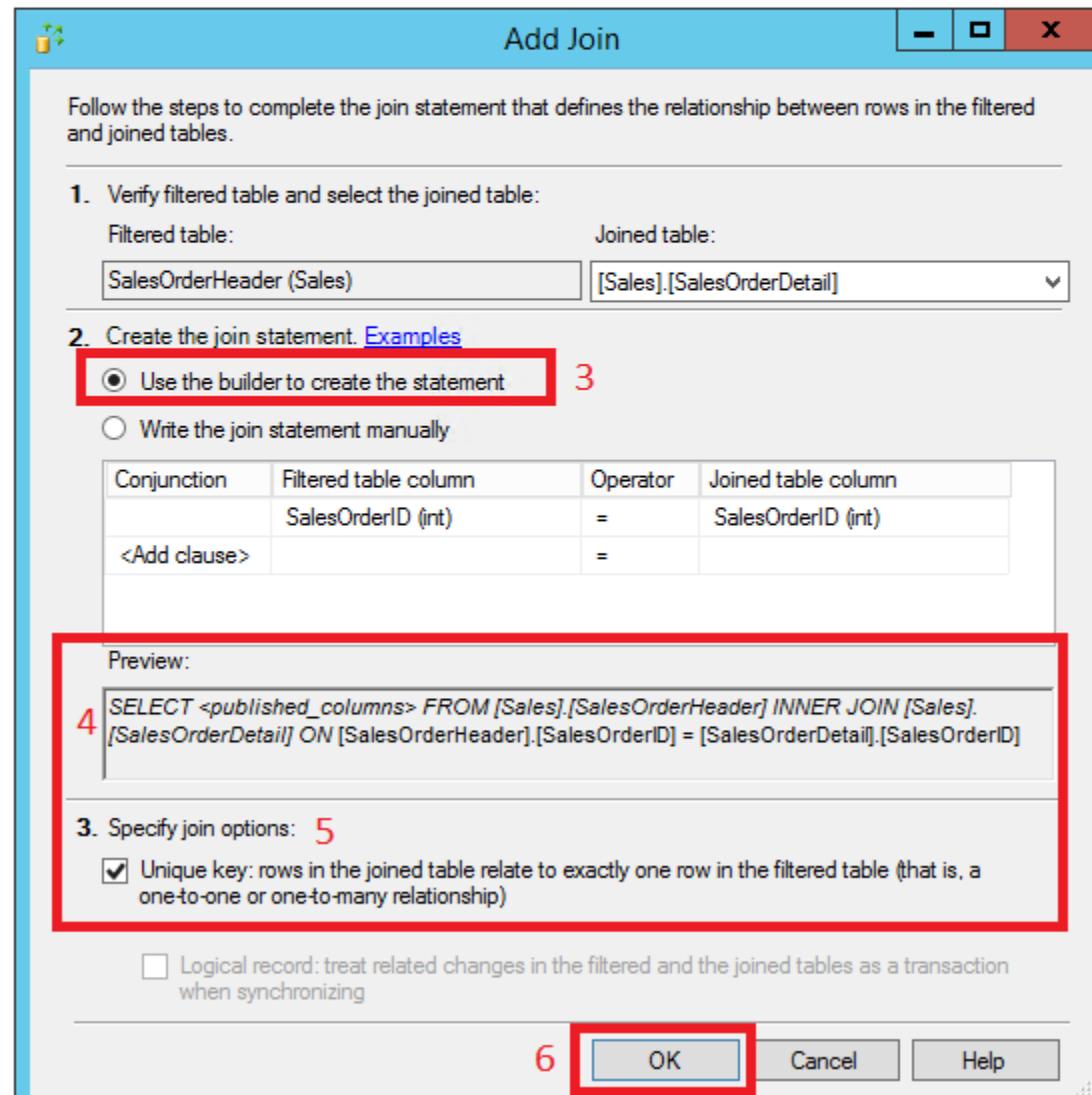
11. On the **Filter Table Rows** page, select **SalesOrderHeader**, select **Add**, and then select **Add Join to Extend the Selected Filter**.

- a. In the **Add Join** dialog box, select **Sales.SalesOrderDetail** under **Joined table**.
- b. Select **Use the Builder to create the statement**.
- c. In the **Preview** box, confirm that the join statement is as follows:

SQLCopy

```
ON [SalesOrderHeader].[SalesOrderID] = [SalesOrderDetail].[SalesOrderID]
```

- d. In **Specify join options**, select **Unique key**, and then select **OK**. Select **Next**.



Follow the steps to complete the join statement that defines the relationship between rows in the filtered and joined tables.

1. Verify filtered table and select the joined table:

Filtered table:

SalesOrderHeader (Sales)

Joined table:

[Sales].[SalesOrderDetail]

2. Create the join statement. [Examples](#)

Use the builder to create the statement

Write the join statement manually

Conjunction	Filtered table column	Operator	Joined table column
	SalesOrderID (int)	=	SalesOrderID (int)
<Add clause>		=	

Preview:

```
SELECT <published_columns> FROM [Sales].[SalesOrderHeader] INNER JOIN [Sales].[SalesOrderDetail] ON [SalesOrderHeader].[SalesOrderID] = [SalesOrderDetail].[SalesOrderID]
```

3. Specify join options:

Unique key: rows in the joined table relate to exactly one row in the filtered table (that is, a one-to-one or one-to-many relationship)

Logical record: treat related changes in the filtered and the joined tables as a transaction when synchronizing

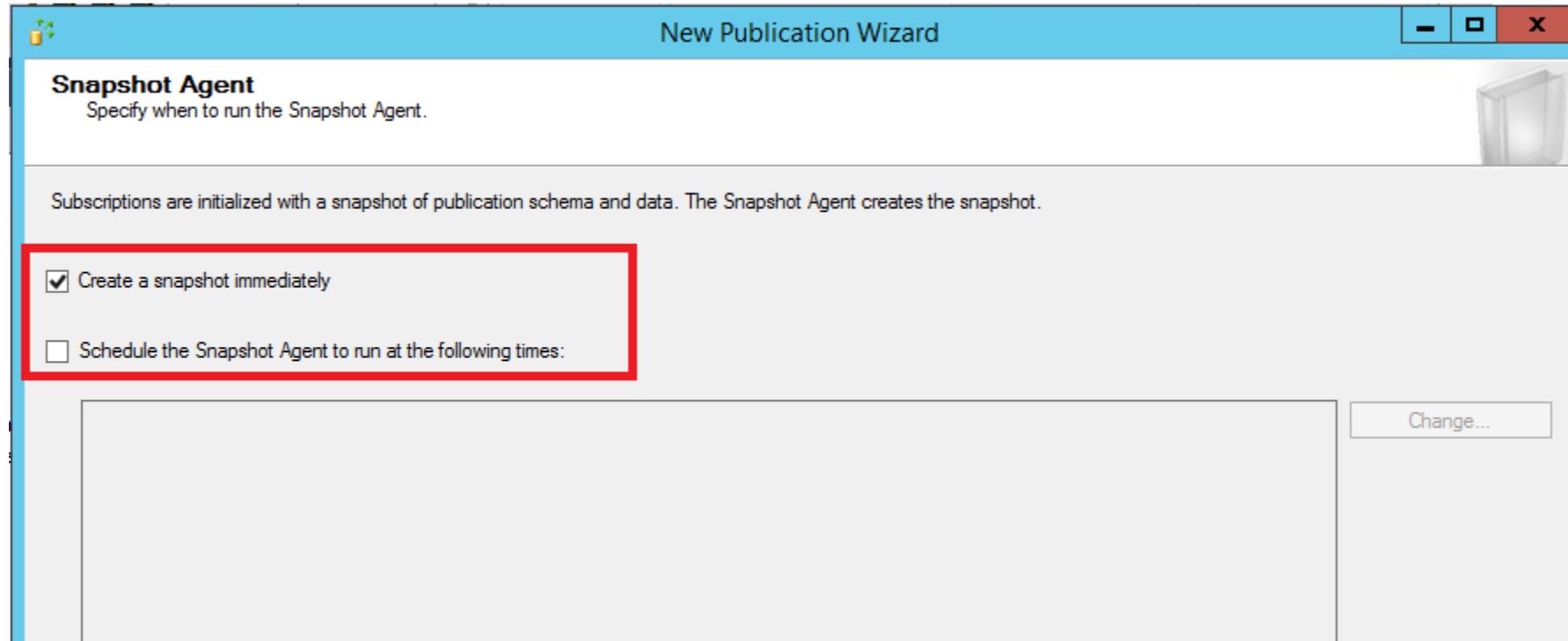
6

OK

Cancel

Help

12. Select **Create a snapshot immediately**, clear **Schedule the snapshot agent to run at the following times**, and select **Next**:



13. On the **Agent Security** page, select **Security Settings**. Enter `<Publisher_Machine_Name>\repl_snapshot` in the **Process account** box, supply the password for this account, and then select **OK**. Select **Next**.

Agent Security

For each agent, specify the account under which it will run and its connection settings.

Snapshot Agent:

Security Settings...

Snapshot Agent Security

Specify the domain or machine account under which the Snapshot Agent process will run.

Run under the following Windows account:

Process account:
Example: domain\account

Password:

Confirm Password:

Run under the SQL Server Agent service account (This is not a recommended security best practice.)

Connect to the Publisher

By impersonating the process account

Using the following SQL Server login:

Login:

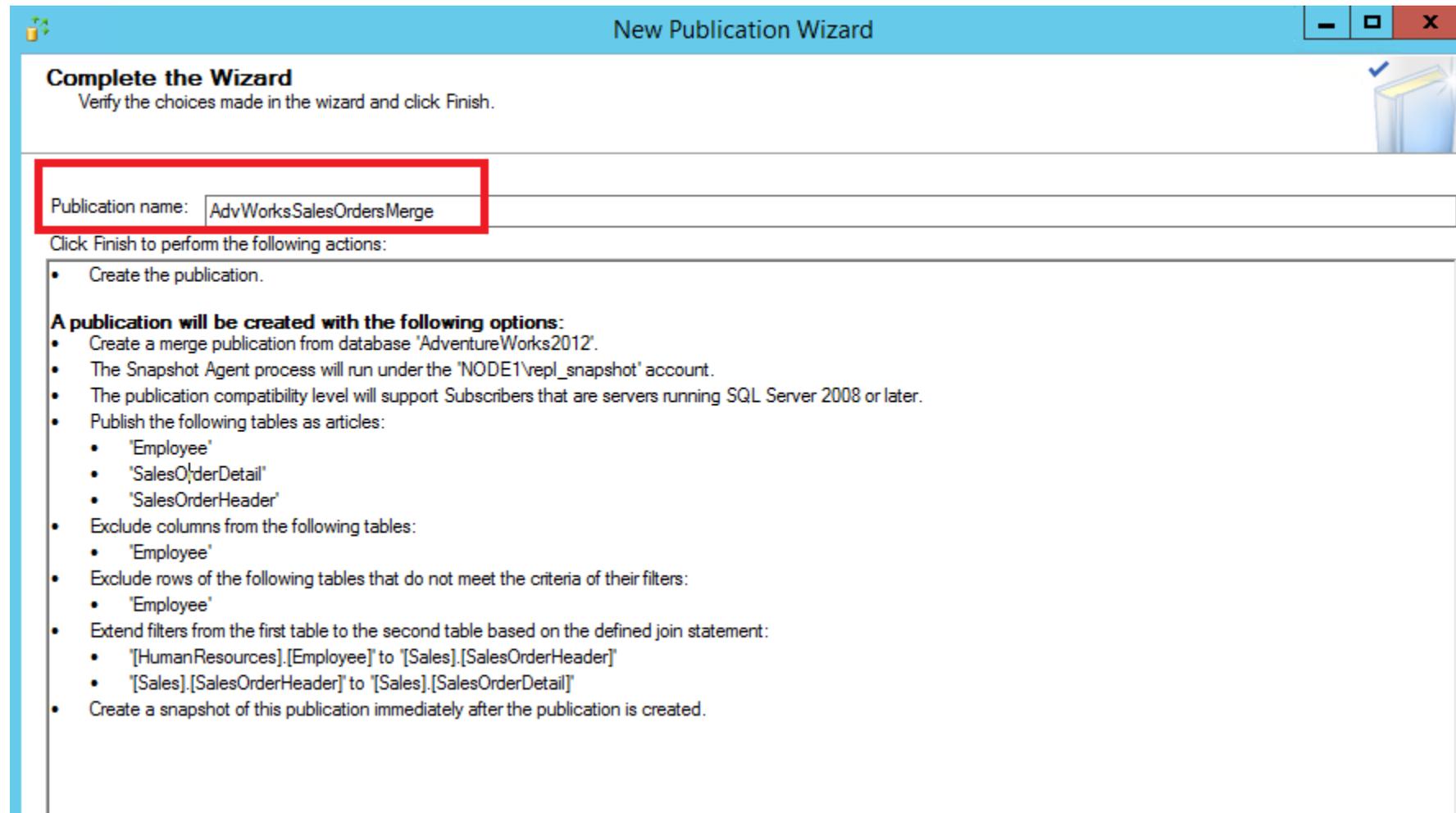
Password:

Confirm Password:

OK Cancel Help

 You must specify a login for each replication agent before continuing the wizard.

14. On the **Complete the Wizard** page, enter **AdvWorksSalesOrdersMerge** in the **Publication name** box and select **Finish**:



15. After the publication is created, select **Close**. Under the **Replication** node in **Object Explorer**, right-click **Local Publications** and select **Refresh** to view your new merge replication.

View the status of snapshot generation

1. Connect to the publisher in SQL Server Management Studio, expand the server node, and then expand the **Replication** folder.
2. In the **Local Publications** folder, right-click **AdvWorksSalesOrdersMerge**, and then select **View Snapshot Agent Status**:

Solution1 - Microsoft SQL Server Management Studio

File Edit View Project Debug Tools Window Help

New Query MDX DMS XML

Object Explorer

Connect

- NODE1\SQL2016 (SQL Server 13.0.1601.5 - SQLREPRO\administrat
 - Databases
 - System Databases
 - Database Snapshots
 - AdventureWorks2012
 - Security
 - Server Objects
 - Replication
 - Local Publications
 - [AdventureWorks2012]: AdvWorksSalesOrdersMerge
 - Local
 - PolyBase
 - Always O
 - Manage
 - Integrati
 - SQL Ser
 - XEvent P

- New Subscriptions...
- New Publication...
- Launch Replication Monitor
- Generate Scripts...
- View Conflicts
- Validate All Subscriptions
- Reinitialize All Subscriptions
- Configure Web Synchronization...
- View Snapshot Agent Status**
- Reports
- Delete
- Refresh
- Properties

View Snapshot Agent Status - AdvWorksSalesOrdersMerge

Agent type: Snapshot Agent

Publication: AdvWorksSalesOrdersMerge

Publication database: [AdventureWorks2012]

Duration: 00:00:22

Last status message:

[100%] A snapshot of 3 article(s) was generated.

Start Stop Monitor Close

3. The current status of the Snapshot Agent job for the publication appears. Ensure that the snapshot job has succeeded before you continue to the next lesson.

Add the Merge Agent login to the PAL

1. Connect to the publisher in SQL Server Management Studio, expand the server node, and then expand the **Replication** folder.
2. In the **Local Publications** folder, right-click **AdvWorksSalesOrdersMerge**, and then select **Properties**.
 - a. Select the **Publication Access List** page, and select **Add**.
 - b. In the **Add Publication Access** dialog box, select *<Publisher_Machine_Name>\repl_merge* and select **OK**. Select **OK** again.

Solution1 - Microsoft SQL Server Management Studio

File Edit View Project Debug Tools Window Help

Object Explorer

Connect [Icons]

- NODE1\SQL2016 (SQL Server 13.0.1601.5 - SQLREPRO\administrat
- Databases
 - System Databases
 - Database Snapshots
 - AdventureWorks2012
- Security
- Server Objects
- Replication
 - Local Publications
 - [AdventureWorks2012]: AdvWorksSalesOrdersMerge

1 **Properties**

Publication Properties - AdvWorksSalesOrdersMerge

Select a page

- General
- Articles
- Filter Rows
- Snapshot
- FTP Snapshot and Internet
- Subscription Options
- 2 **Publication Access List**
- Agent Security
- Data Partitions

Script Help

The publication access list specifies the logins with permissions to create and synchronize subscriptions.

Publication access list:

Login name	Type
sa	Standard
SQLREPRO\Administrator	Windows user
NT SERVICE\Winmgmt	Windows user
NT SERVICE\SQLWriter	Windows user
NT Service\...	
NT SERVICE...	
distributor_ad...	

3 **Add...**

Remove

Remove All

Add Publication Access

You can add any login to the publication access list that has access to database 'AdventureWorks2012' and that is defined at both the Publisher and Distributor.

Login name	Type
NODE1\repl_distribution	Windows user
NODE1\repl_logreader	Windows user
4 NODE1\repl_merge	Windows user
NODE1\repl_snapshot	Windows user

5 **OK**

Cancel

Progress: Ready

For more information, see:

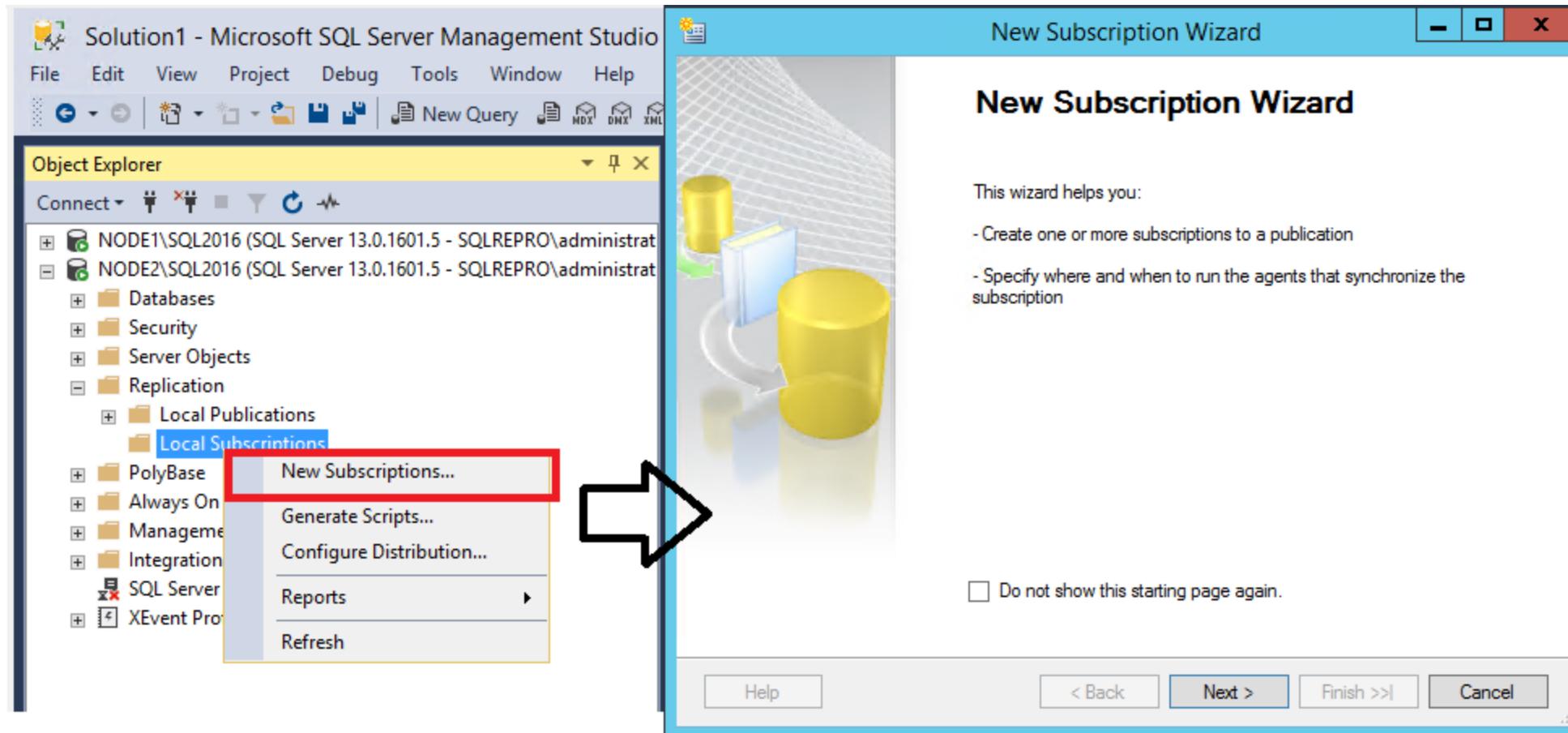
- [Filter published data](#)
- [Parameterized row filters](#)
- [Define an article](#)

Create a subscription to the merge publication

In this section, you add a subscription to the merge publication that you created previously. This tutorial uses the remote subscriber (NODE2\SQL2016). You then set permissions on the subscription database and manually generate the filtered data snapshot for the new subscription.

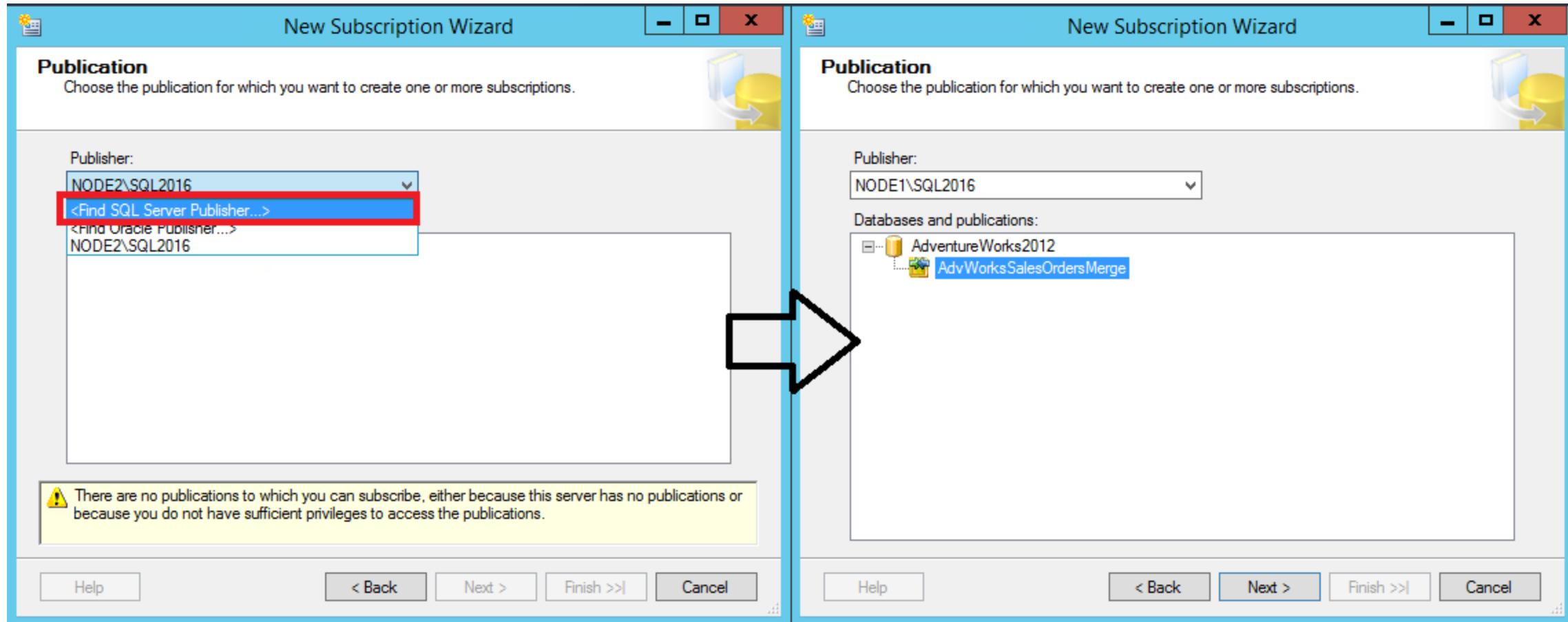
Add a subscriber for merge publication

1. Connect to the subscriber in SQL Server Management Studio, and expand the server node. Expand the **Replication** folder, right-click the **Local Subscriptions** folder, and then select **New Subscriptions**. The New Subscription Wizard starts:

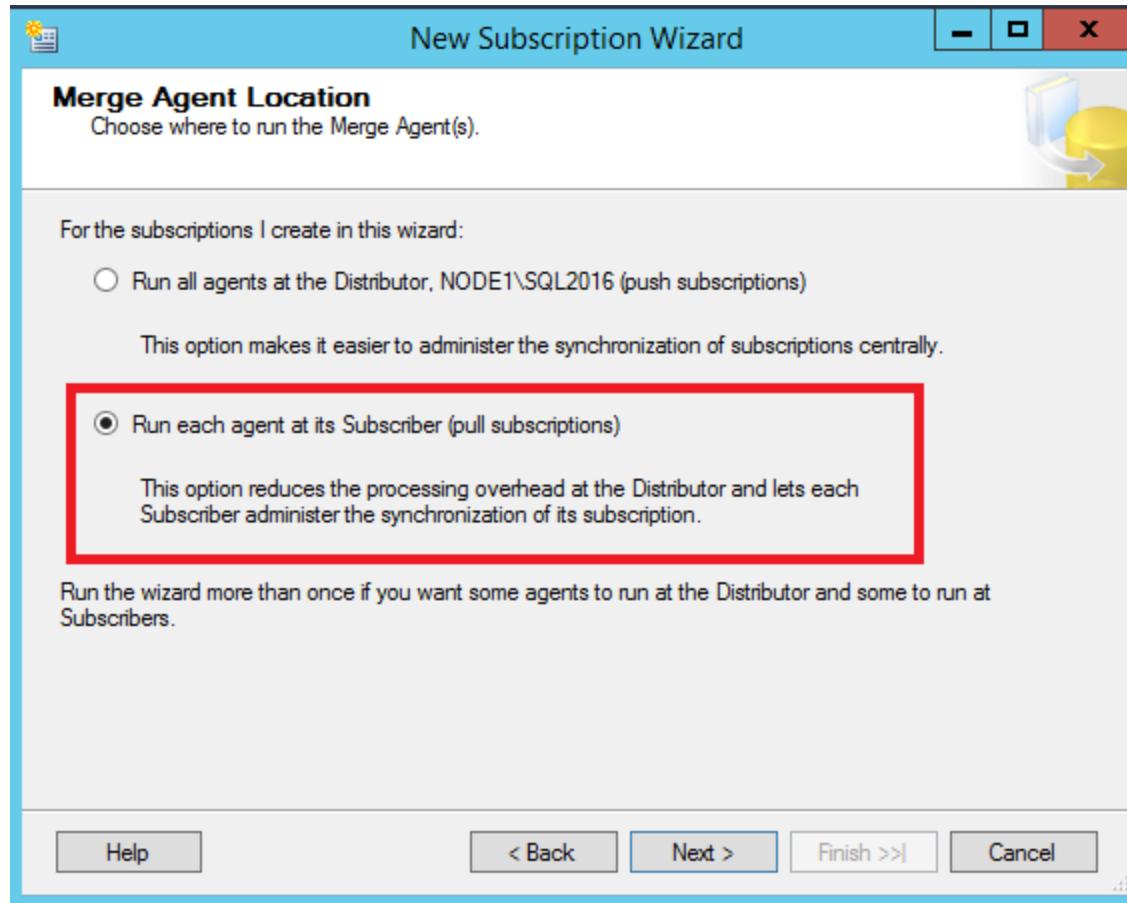


2. On the **Publication** page, select **Find SQL Server Publisher** in the **Publisher** list.

In the **Connect to Server** dialog box, enter the name of the publisher instance in the **Server name** box, and select **Connect**.

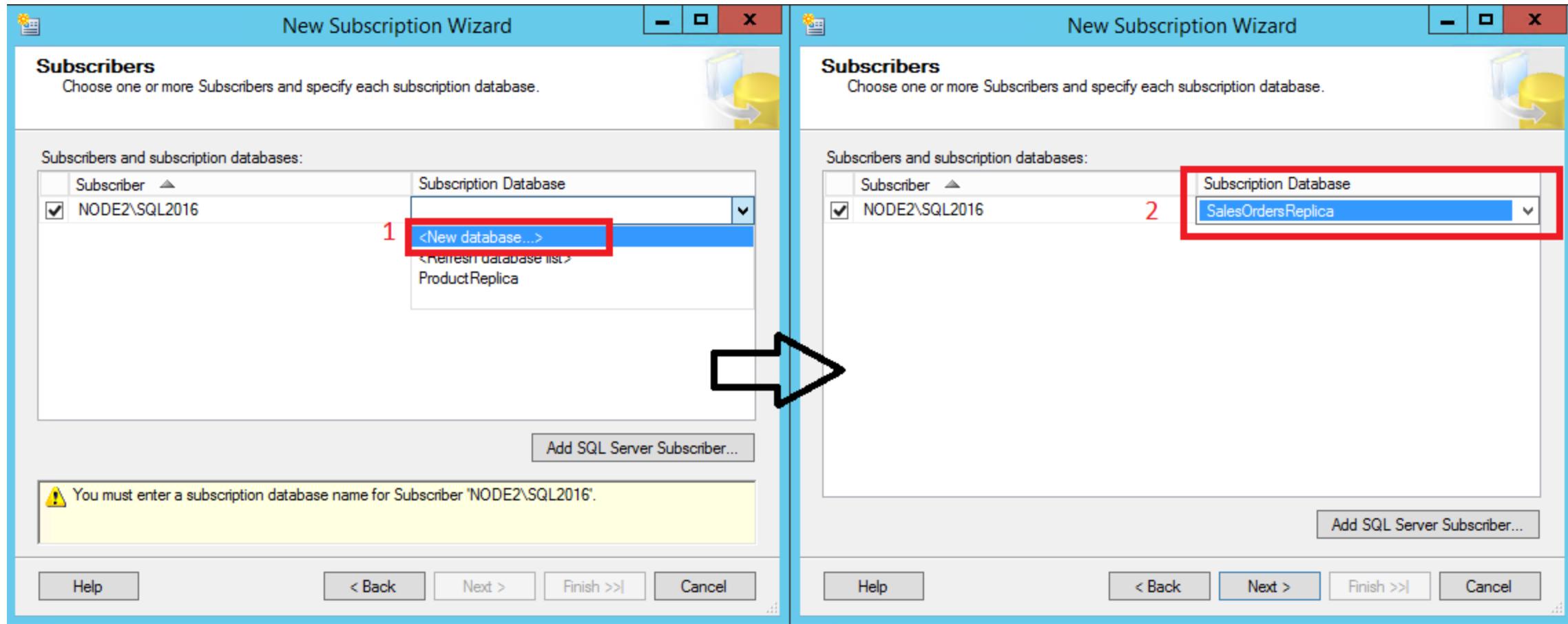


3. Select **AdvWorksSalesOrdersMerge**, and select **Next**.
4. On the **Merge Agent Location** page, select **Run each agent at its Subscriber**, and then select **Next**:

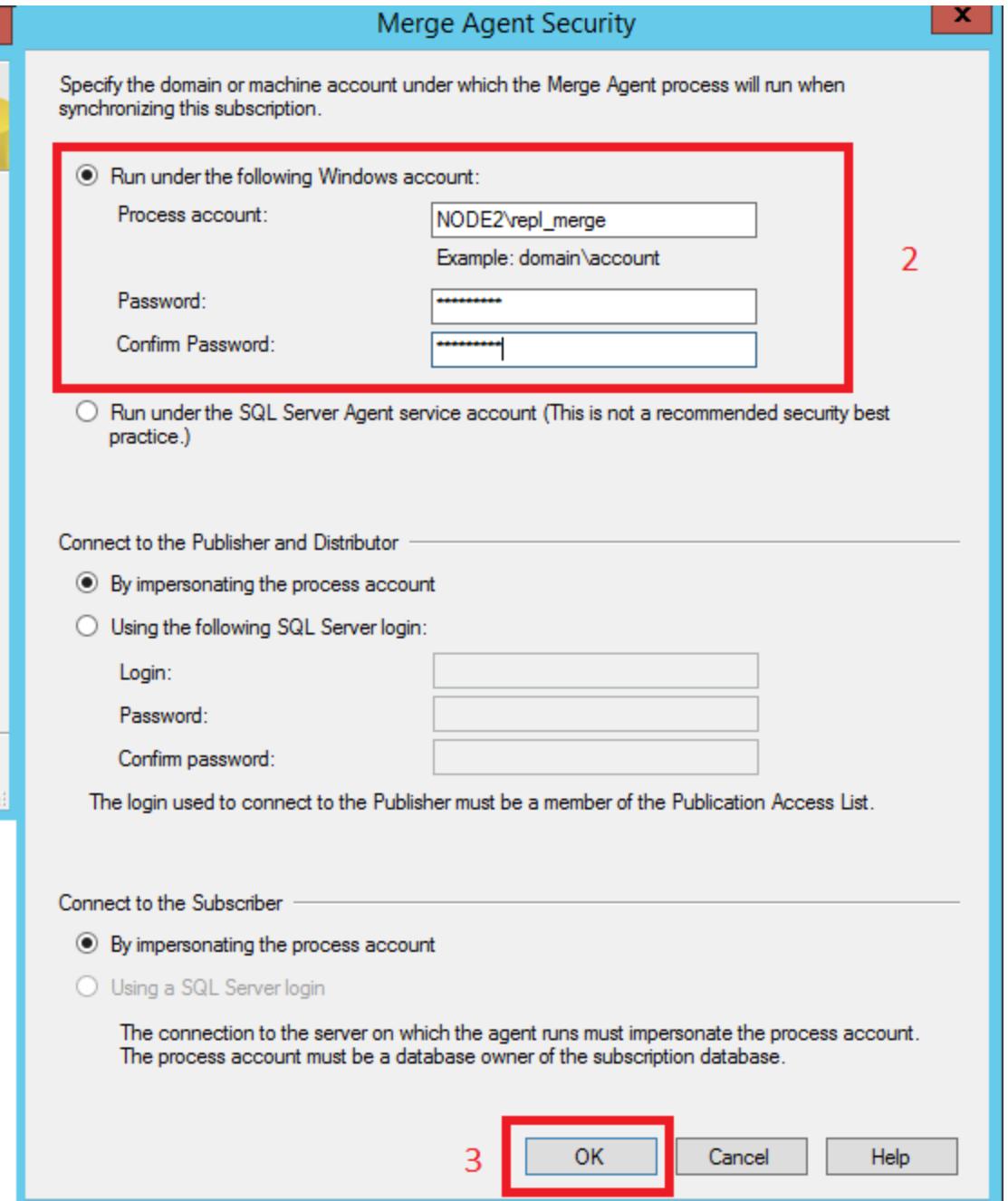
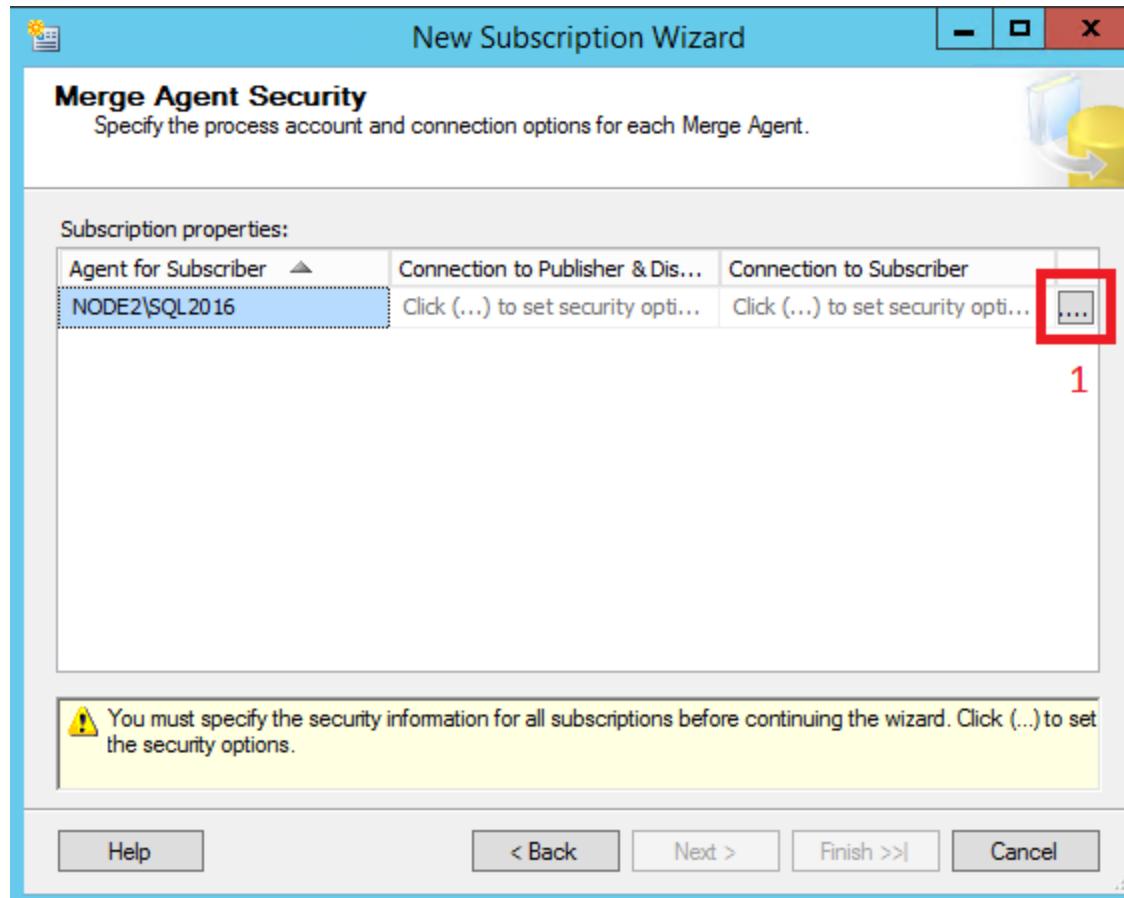


5. On the **Subscribers** page, select the instance name of the subscriber server. Under **Subscription Database**, select **New Database** from the list.

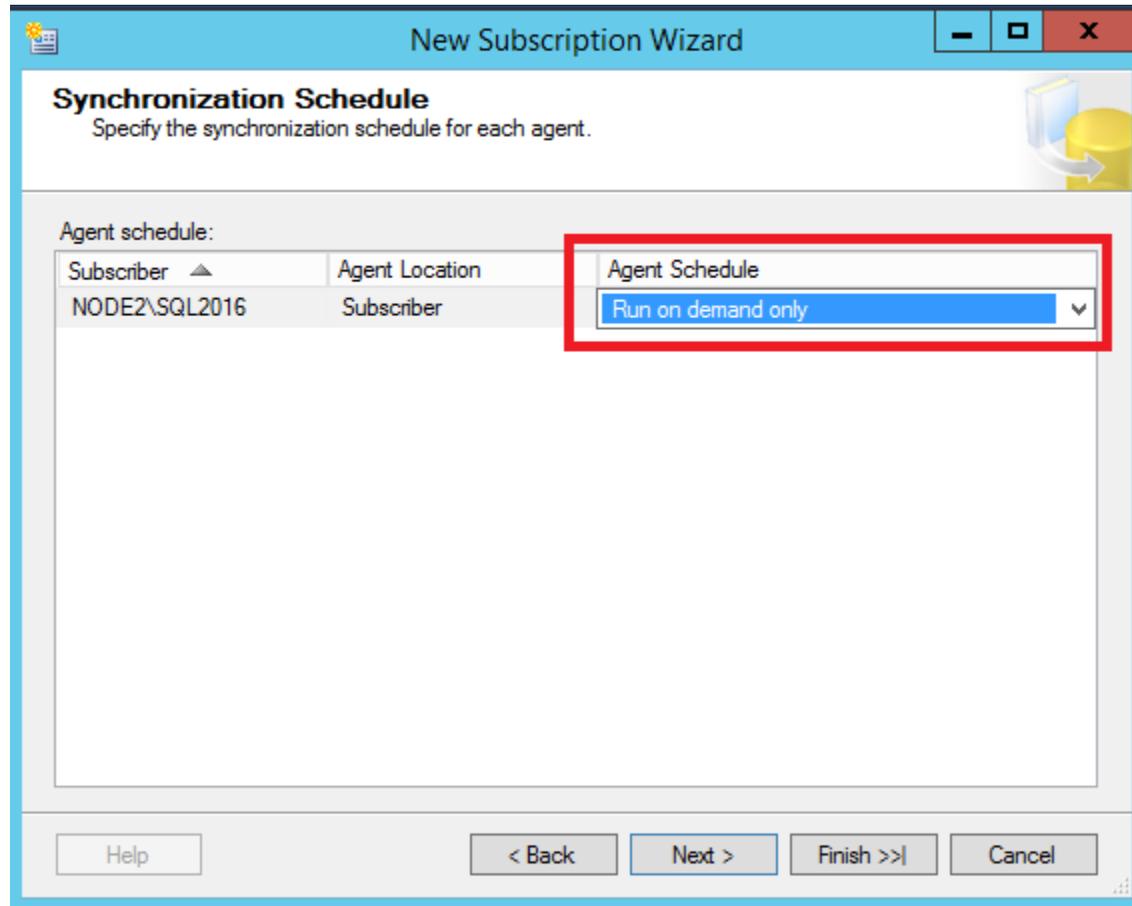
In the **New Database** dialog box, enter **SalesOrdersReplica** in the **Database name** box. Select **OK**, and then select **Next**.



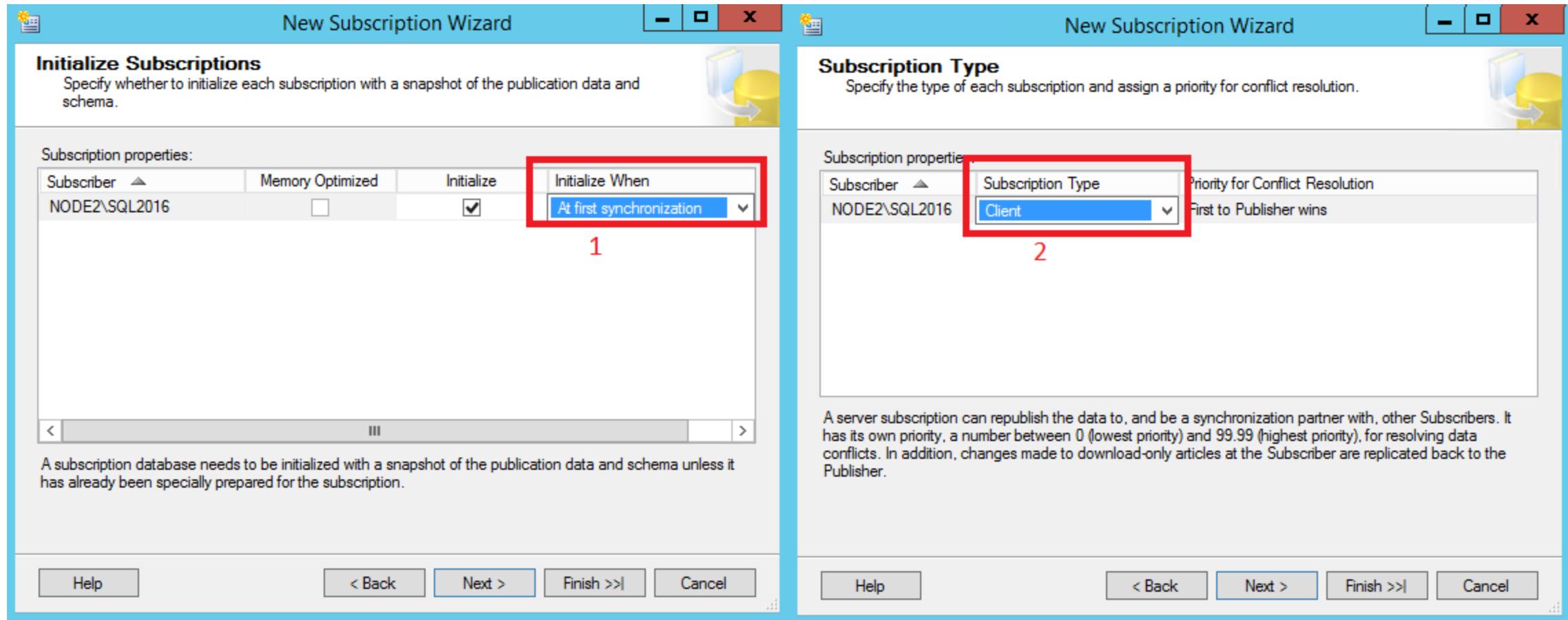
6. On the **Merge Agent Security** page, select the ellipsis (...) button. Enter `<Subscriber_Machine_Name> \repl_merge` in the **Process account** box, and supply the password for this account. Select **OK**, select **Next**, and then select **Next** again.



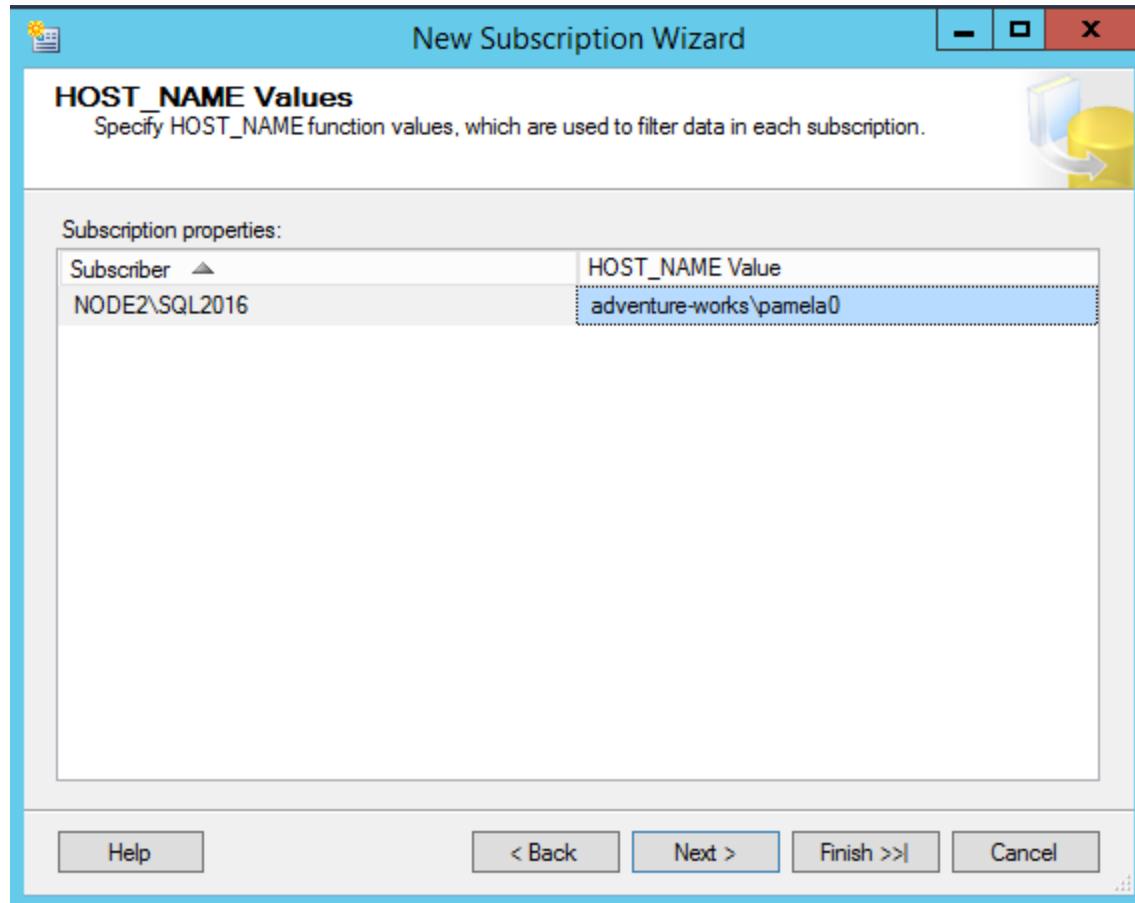
7. On the **Synchronization Schedule** page, set **Agent Schedule** to **Run on demand only**. Select **Next**.



8. On the **Initialize Subscriptions** page, select **At first synchronization** from the **Initialize When** list. Select **Next** to proceed to the **Subscription Type** page, and select the appropriate subscription type. This tutorial uses **Client**. After you select the subscription type, select **Next** again.



9. On the **HOST_NAME Values** page, enter a value of **adventure-works\pamela0** in the **HOST_NAME Value** box. Then select **Finish**.

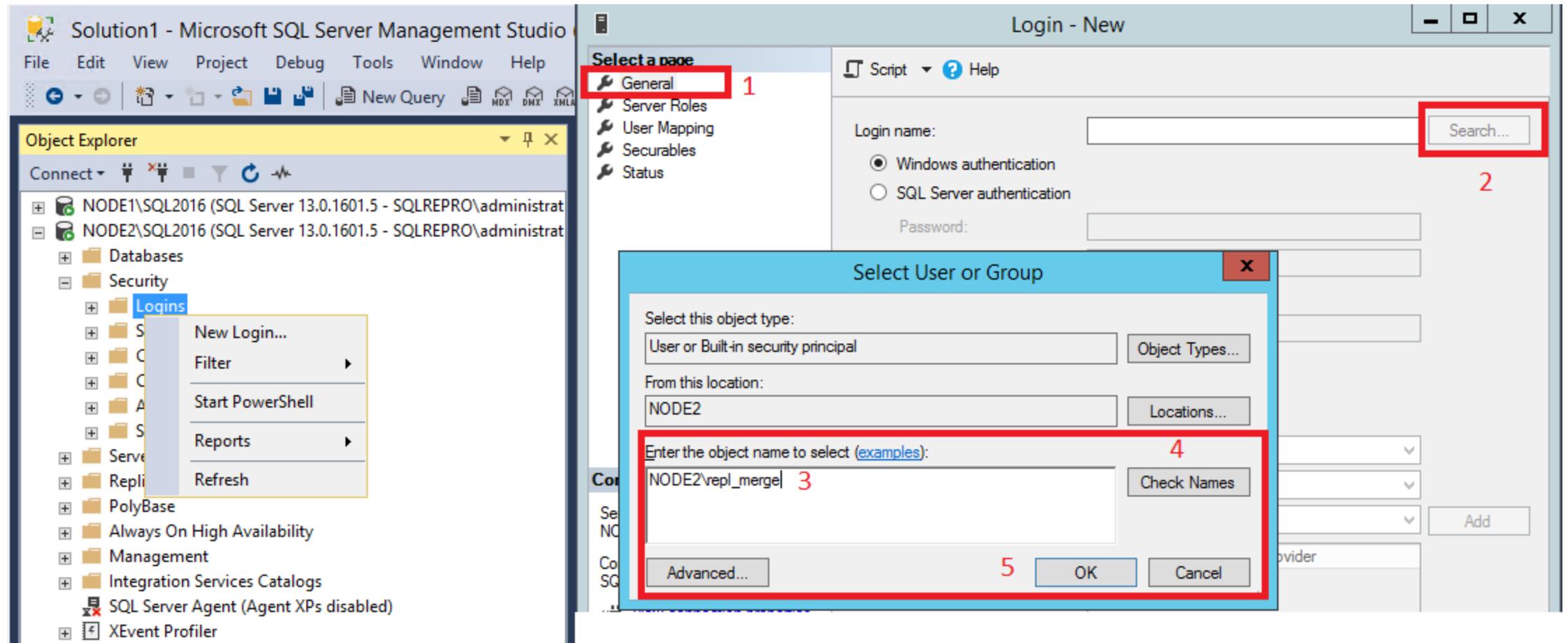


10. Select **Finish** again. After the subscription is created, select **Close**.

Set server permissions at the subscriber

1. Connect to the subscriber in SQL Server Management Studio. Expand **Security**, right-click **Logins**, and then select **New Login**.

On the **General** page, select **Search** and then enter `<Subscriber_Machine_Name>\repl_merge` in the **Enter the Object Name** box. Select **Check Names**, and then select **OK**.



2. On the **User Mapping** page, select the **SalesOrdersReplica** database and select the **db_owner** role. On the **Securables** page, grant the **Explicit** permission to **Alter Trace**. Select **OK**.

Login - New

Select a page

- General
- Server Roles
- User Mapping** 1
- Securables
- Status

Script Help

Users mapped to this login:

Map	Database	User	Default Schema
<input type="checkbox"/>	master		
<input type="checkbox"/>	model		
<input type="checkbox"/>	msdb		
<input type="checkbox"/>	ProductReplica		
<input checked="" type="checkbox"/>	SalesOrdersReplica	NODE2\repl_merge	
<input type="checkbox"/>	tempdb		

Guest account enabled for: SalesOrdersReplica

Database role membership for: SalesOrdersReplica

- db_accessadmin
- db_backupoperator
- db_datareader
- db_datawriter
- db_ddladmin
- db_denydatareader
- db_denydatawriter
- db_owner 3
- db_securityadmin
- public

Connection

Server: NODE2\SQL2016

Connection: SQLREPRO\administrator

[View connection properties](#)

Progress

Ready

OK Cancel

Login Properties - NODE2\repl_merge

Select a page

- General
- Server Roles
- User Mapping
- Securables** 4
- Status

Script Help

Login name: NODE2\repl_merge

Securables:

Name
NODE2\SQL2016

Permissions for NODE2\SQL2016:

Explicit Effective

Permission	Grantor	Grantee
Alter resources		
Alter server state		
Alter settings		
Alter trace		
Authenticate server		
Connect Any Database		
Connect SQL		

Progress

Ready

5

Create the filtered data snapshot for the subscription

1. Connect to the publisher in SQL Server Management Studio, expand the server node, and then expand the **Replication** folder.
2. In the **Local Publications** folder, right-click the **AdvWorksSalesOrdersMerge** publication, and then select **Properties**.
 - a. Select the **Data Partitions** page, and select **Add**.
 - b. In the **Add Data Partition** dialog box, enter **adventure-works\pamela0** in the **HOST_NAME Value** box, and then select **OK**.
 - c. Select the newly added partition, select **Generate the selected snapshots now**, and then select **OK**.

Solution1 - Microsoft SQL Server Management Studio

File Edit View Project Debug Tools Window Help

Object Explorer

Connect

- NODE1\SQL2016 (SQL Server 13.0.1601.5 - SQLREPRO\administrat
 - Databases
 - System Databases
 - Database Snapshots
 - AdventureWorks2012
 - Security
 - Server Objects
 - Replication
 - Local Publications
 - [AdventureWorks2012]: AdvWorksSalesOrdersMerge
 - Local S
 - PolyBase
 - Always On
 - Manageme
 - Integration
 - SQL Server
 - Jobs
 - Job Act
 - Alerts
 - Operate
 - Proxies
 - Error Lo
 - XEvent Pro

1

Properties

Publication Properties - AdvWorksSalesOrdersMerge

Select a page

- General
- Articles
- Filter Rows
- Snapshot
- FTP Snapshot and Internet
- Subscription Options
- Publication Access List
- Agent Security
- Data Partitions

Script Help

HOST_NAME value Current snapshot Schedule

2

3

4

Generate the selected snapshots now

Clean up the existing snapshots

Automatically generate snapshots

Automatically define a partition and generate a snapshot if needed when a new Subscriber tries to synchronize

OK Cancel

Add Data Partition

HOST_NAME: adventure-works\pamela0

Schedule the Snapshot Agent for this partition to run at the following time(s):

Run on demand only

Change...

OK Cancel

For more information, see:

- [Subscribe to publications](#)
- [Create a pull subscription](#)
- [Snapshots for merge publications with parameterized filters](#)

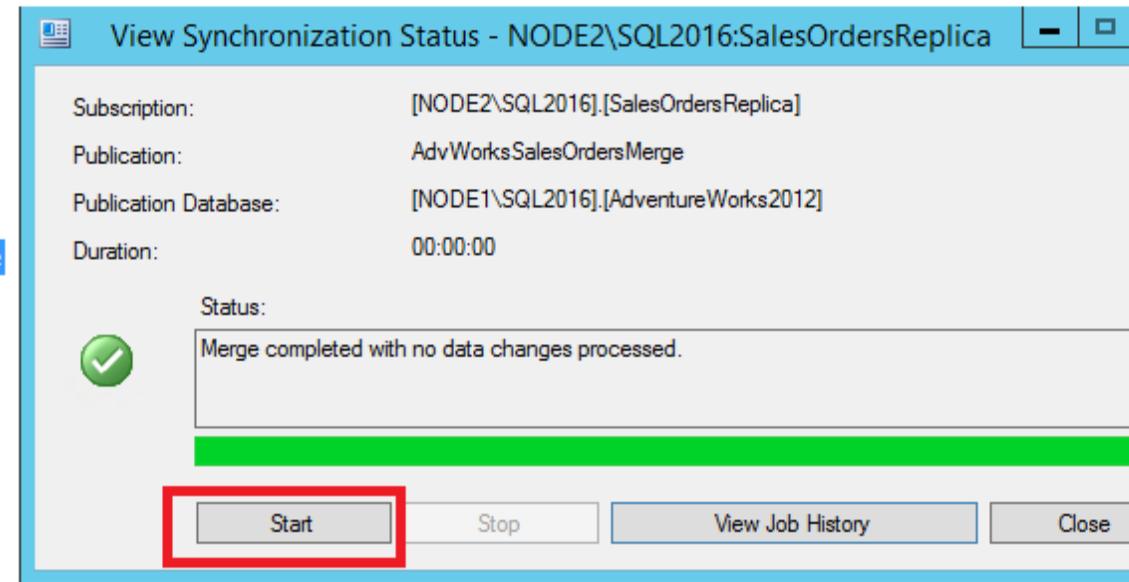
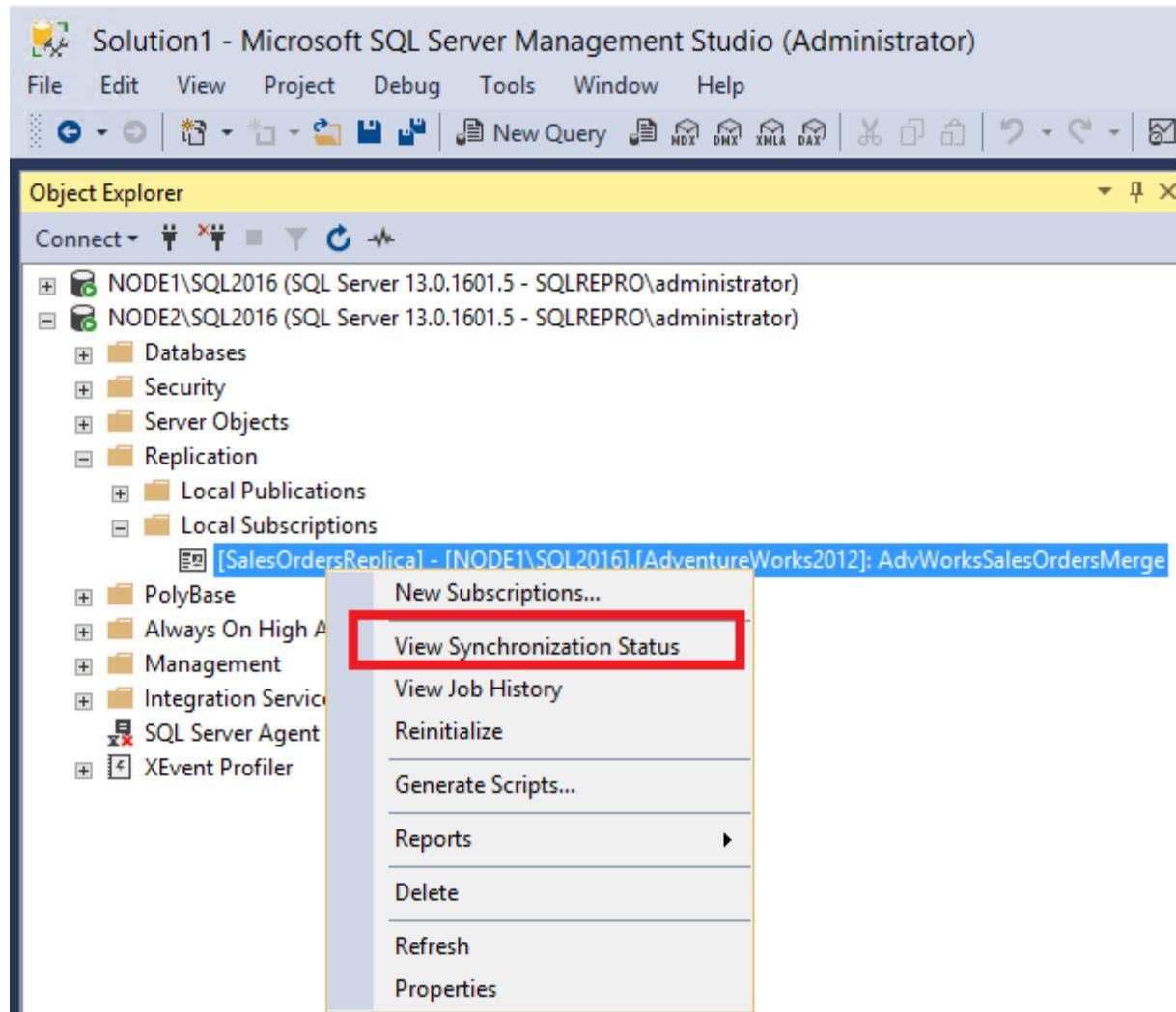
Synchronize the subscription to the merge publication

In this section, you start the Merge Agent to initialize the subscription by using SQL Server Management Studio. You also use this procedure to synchronize with the publisher.

Start synchronization and initialize the subscription

1. Connect to the subscriber in SQL Server Management Studio.
2. Make sure that the SQL Server Agent is running. If it's not, right-click the SQL Server Agent in Object Explorer and select **Start**. If this step fails to start your agent, you'll need to do so manually by using SQL Server Configuration Manager.
3. Expand the **Replication** node. In the **Local Subscriptions** folder, right-click the subscription in the **SalesOrdersReplica** database, and then select **View Synchronization Status**.

Select **Start** to initialize the subscription.



Next steps

You have successfully configured both your publisher and your subscriber for your merge replication. You can also:

1. Insert, update, or delete data in the **SalesOrderHeader** or **SalesOrderDetail** table at the publisher or subscriber.
2. Repeat this procedure when network connectivity is available to synchronize data between the publisher and the subscriber.
3. Query the **SalesOrderHeader** or **SalesOrderDetail** table at the other server to view the replicated changes.

For more information, see:

- [Initialize a subscription with a snapshot](#)
- [Synchronize data](#)
- [Synchronize a pull subscription](#)