Ministerul Educației al Republicii Moldova
Universitatea Tehnică a Moldovei
Facultatea Calculatoare, Informatică și Microelectronică
Ingineria Software

REPORT

Laboratory work Nr.2

Database creation and maintenance

Realized by: Popa Eugeniu
FAF-202

Chișinău, 2021

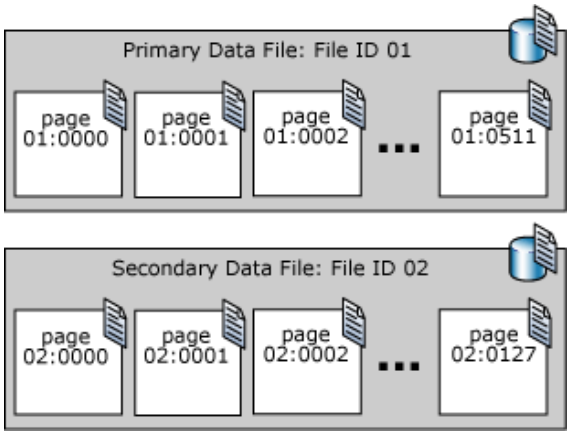
The theoretical part

1. File types used in Microsoft SQL Server 2019

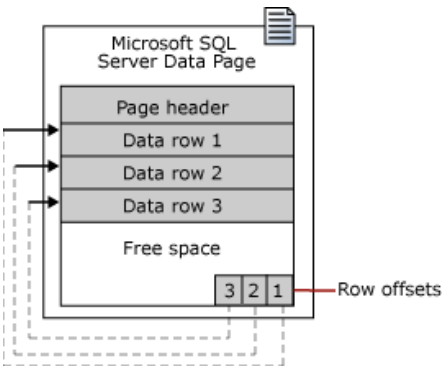
- Primary
- Secondary
- Log

2. The structure of the data storage pages

The first page of each file is the header page that contained data about its attributes. The next few pages also contain system data, such as allocation schemes. One from the system pages, stored both in the primary file and in the first log-file is the boot page of the database data that contained data about its attributes.



In SQL Server, the page size is 8 Kb, which means that a database contained 128 pages per 1 Mb. Each page starts with a 96-byte header, which is used for storing system information about that page. This information includes: page number, type them, the volume of free space on the page and the ID associated with the object, owner of this page. The data rows are placed on the page sequentially, starting immediately after the header. Table row offset table begins at the end of each page, and this table contained a entry for each row on the page. Each cell shows how far from the top of the page it is the first byte of the row. The entries in the address table are in the reverse order of the rows on the page.



Extents is a row of 8 pages and is used for efficient management of pages. All pages are stored in extents. The 8 pages occupy 64 Kb, hence the database SQL Server has 16 extents per 1Mb.

To optimize the allocated space, SQL Server does not allocate integer extents for tables with a small data volume. SQL Server has 2 types of extents:

• Uniform extents - belong to a single object, all 8 pages can only be used by the owner object.

• Mixed extents - up to 8 objects can be shared. Each of these 8 pages of extent can had different owners.

3. System databases, their importance and role.

The SQL Server 2019 SGBD includes the following system databases:

master

In the master database, all system-level information of SQL Server is recorded. This includes metadata instances, such as: login accounts, network points, interconnected servers, and system configuration settings. The master database also contains data about the existence of all other data stores and about the locations of their files. In addition, the master also keeps the SQL Server system initiation information, which means that the system cannot start if the database is not available.

msdb

It is used by SQL Server Agent to store data about alerts, plans work, services, etc. Also, here are kept other service data such as, for example, about the copies of book.

model

Used as a template for all databases created in SQL Server. The changes made for the model database as: size, collation, recovery model and other options will be applied to all subsequently created databases.

Resource

It is a read-only database and contains system objects included in SQL Server 2017. The system objects persist physically in the Resources database, but, logically, they appear in the sys schema of each database. This database is not visible in the system interface.

tempdb

The tempdb system database is a global source accessible to all users connected to SQL Server instance and contains all temporary tables and temporarily stored procedures.

It also covers all the needs of a temporary storage space for the generated work tables of SQL Server.

4. Principles of database creation in SQL Server Management Studio environment.

Limitations and Restrictions

- A maximum of 32,767 databases can be specified on an instance of SQL Server.

Prerequisites

- The CREATE DATABASE statement must run in autocommit mode (the default transaction management mode) and is not allowed in an explicit or implicit transaction.

Recommendations

- The master database should be backed up whenever a user database is created, modified, or dropped.
- When you create a database, make the data files as large as possible based on the maximum amount of data you expect in the database.

Security

Permissions

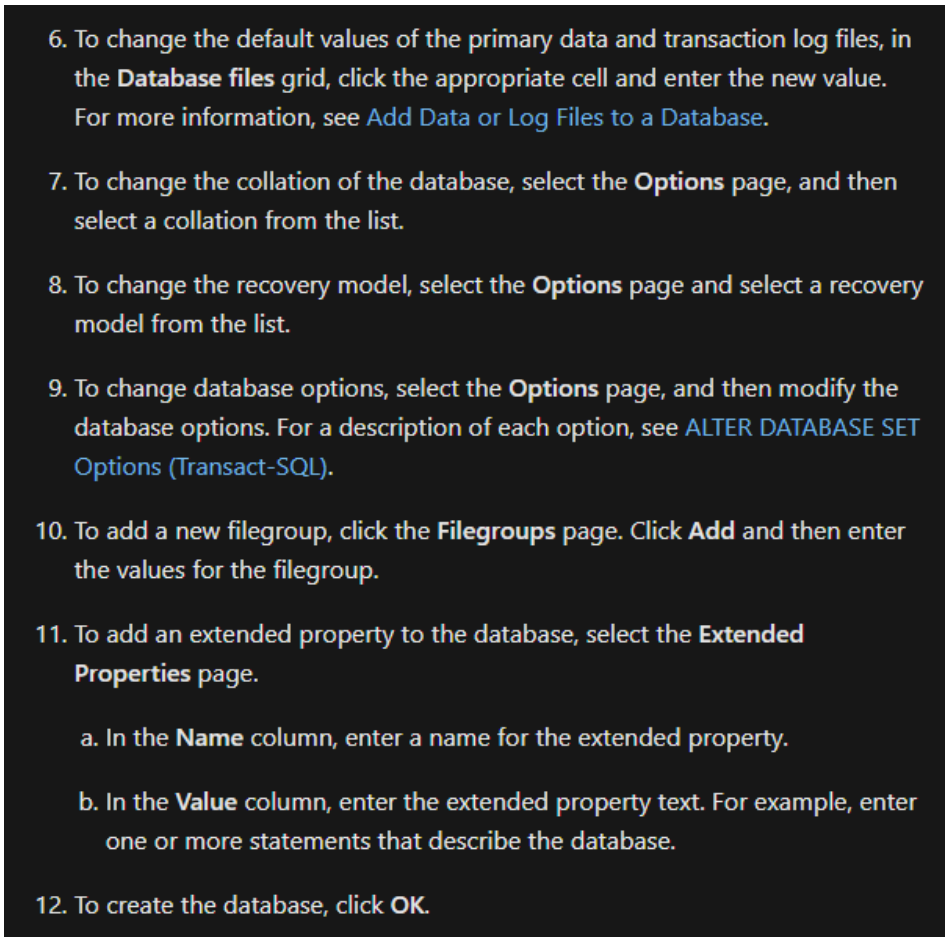
Requires CREATE DATABASE permission in the master database, or requires CREATE ANY DATABASE, or ALTER ANY DATABASE permission.

To maintain control over disk use on an instance of SQL Server, permission to create databases is typically limited to a few login accounts.

Using SQL Server Management Studio

To create a database

1. In **Object Explorer**, connect to an instance of the SQL Server Database Engine and then expand that instance.
2. Right-click **Databases**, and then click **New Database**.
3. In **New Database**, enter a database name.
4. To create the database by accepting all default values, click **OK**; otherwise, continue with the following optional steps.
5. To change the owner name, click (...) to select another owner.



5. What is a database maintenance plan and what are the techniques for creating a database maintenance plan?

Maintenance plans can be used to perform the tasks required to maintain a good functioning of the database, for creating backups in case of system errors and for checking the consistency of the database. Although, for the creation of the maintenance plan, it can be used the respective assistant (Maintenance Plan Wizard), its manual creation offers a greater flexibility.

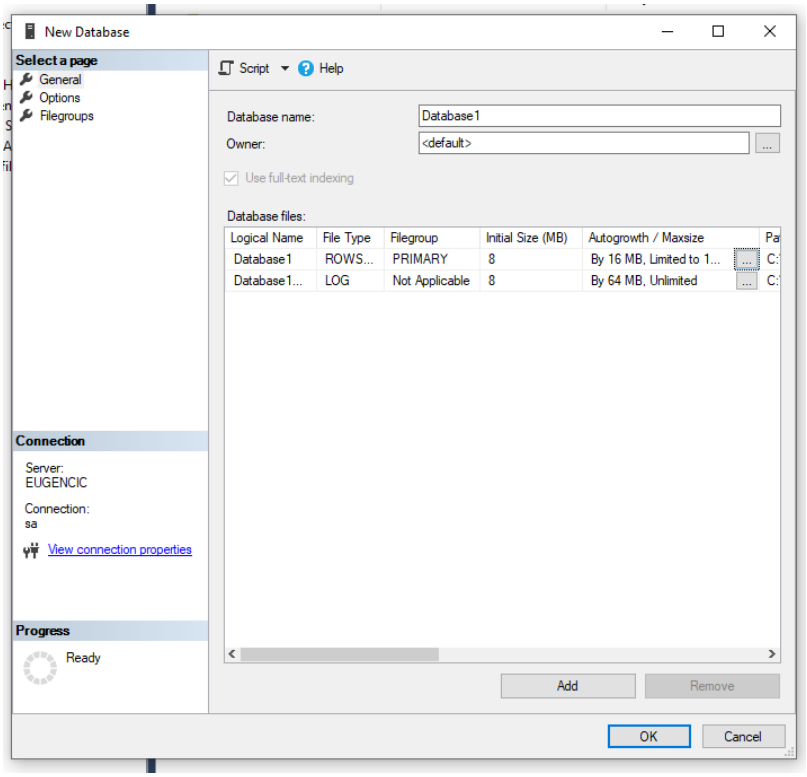
In the SQL Server 2017 SGBD, the maintenance plan is a program that performs maintenance tasks of the database in time intervals according to it.

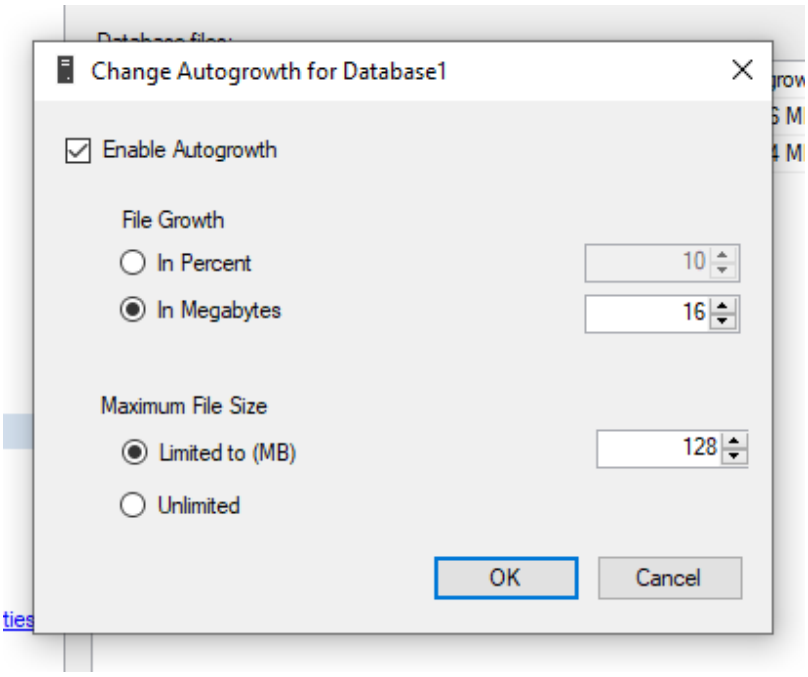
To create and manage maintenance tasks, the user must be a member of the role sysadmin.

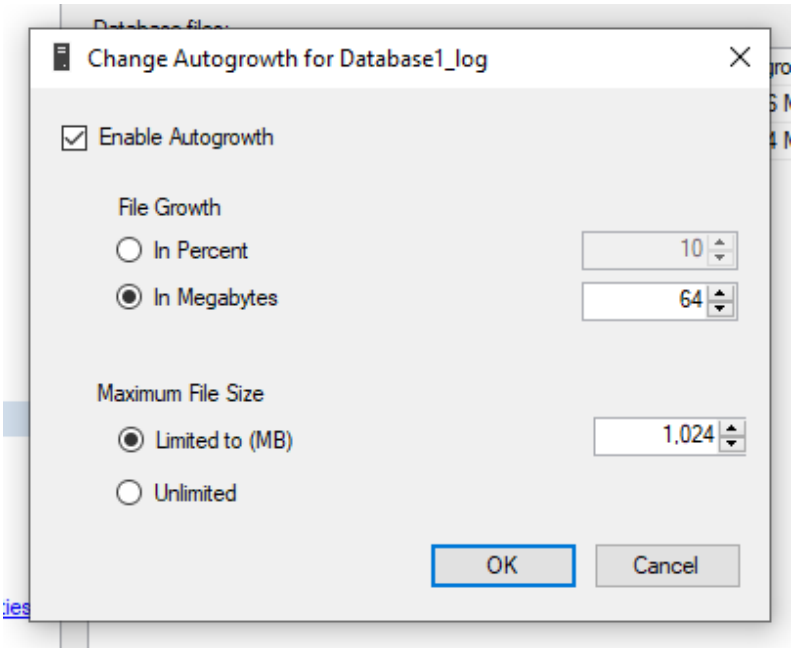
There are two ways to create the maintenance plan: using its plan creation wizard using the design surface. The wizard is best for creating a maintenance plan that would serve as the basis, while the use of the design surface allows the user to carry out operations plan development.

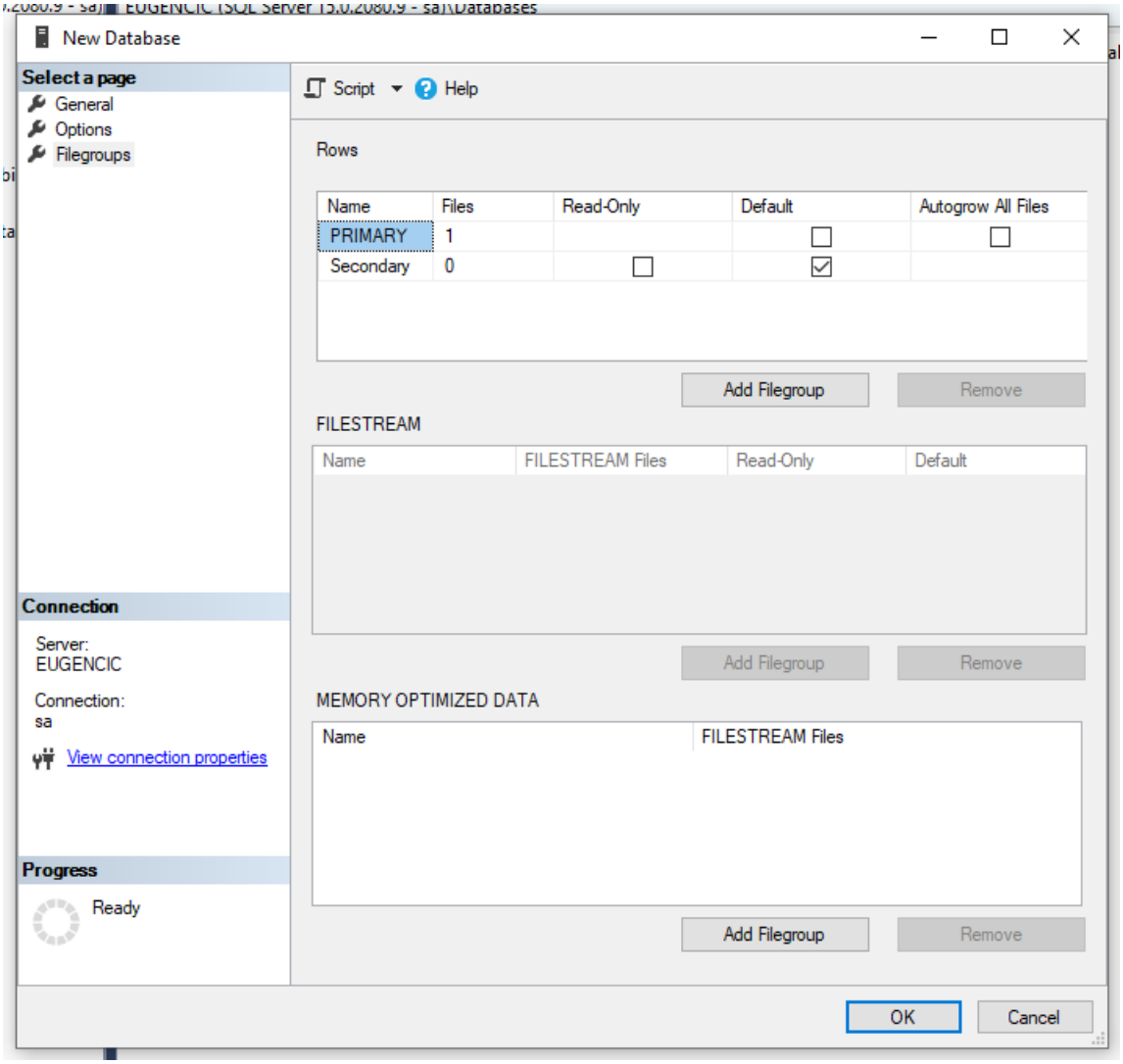
The practical part

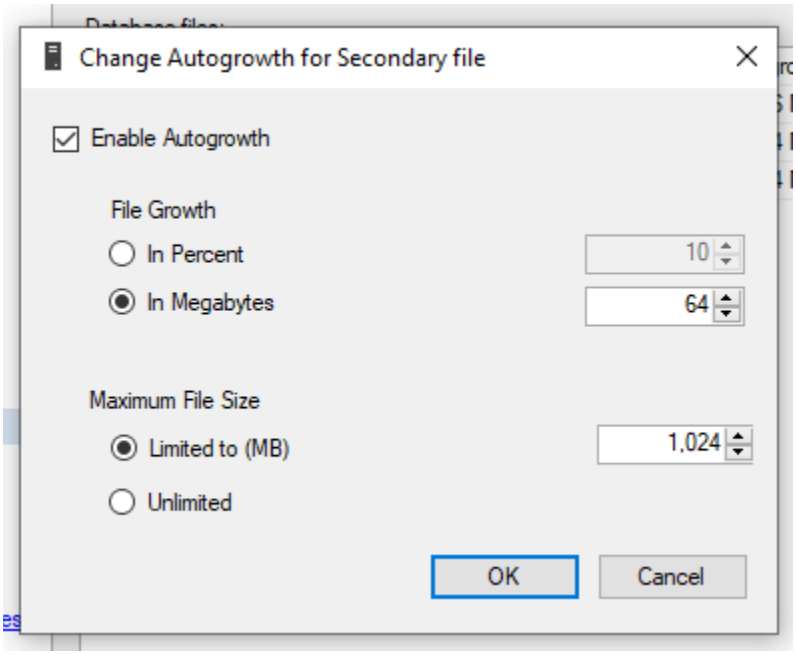
l. Create a database physically placed in the MyDocuments \ Data folder, setting a file growth the base of the 16MB with the growth limit of 128 MB and the 64 MB log with the 1024 MB growth. Define a new default Filegroup for secondary files, setting the secondary file size to 64 MB with a limit of 1024 MB.

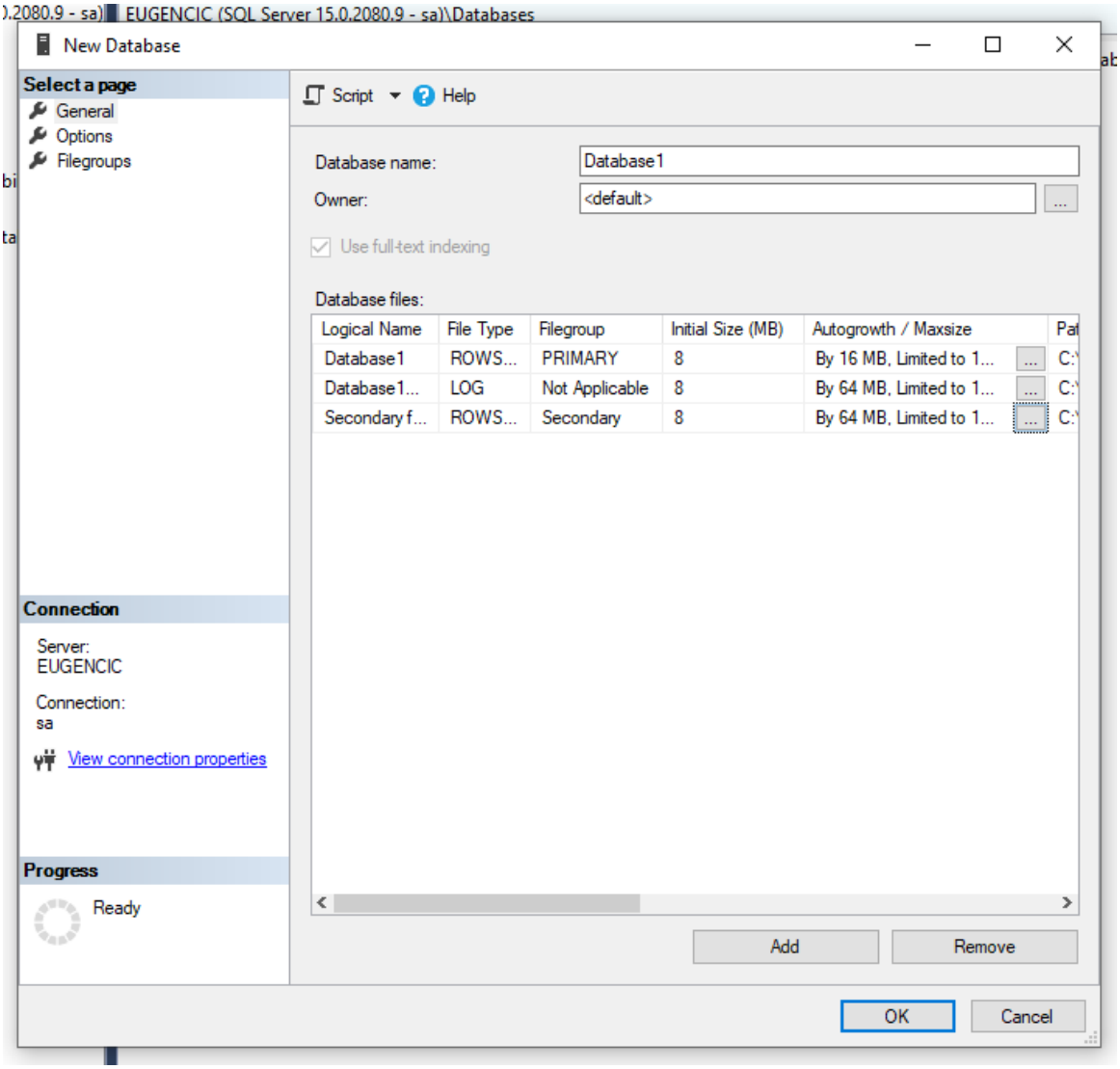




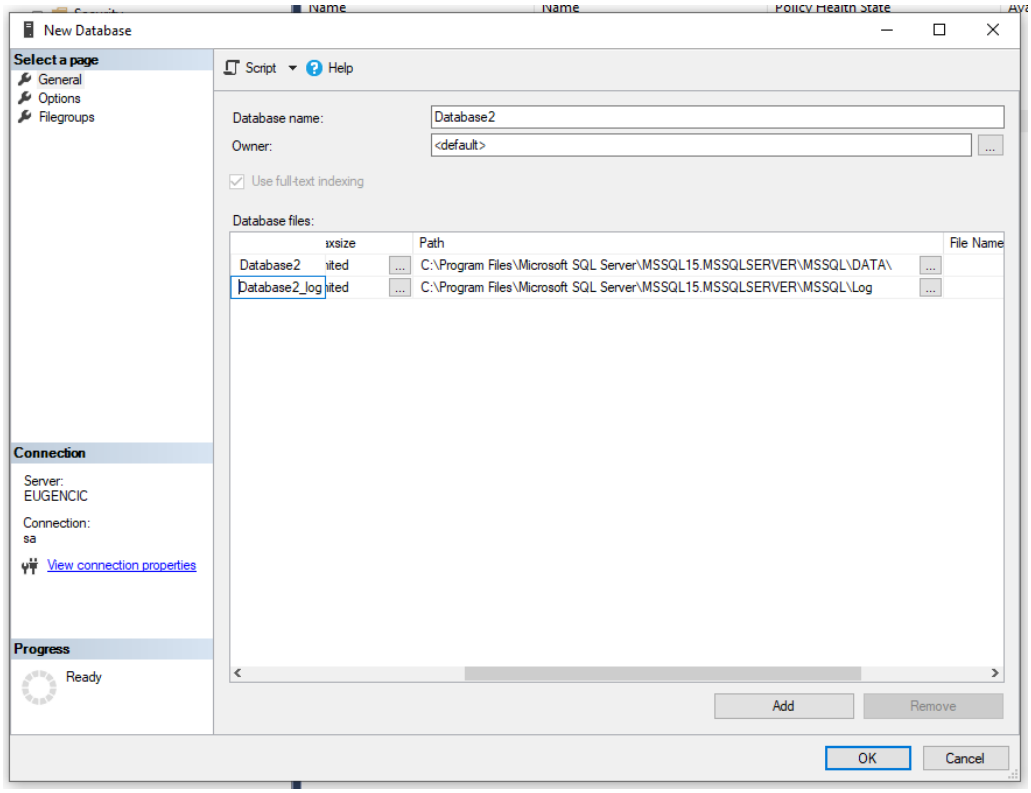

Change Autogrowth for Database1_log
Enable Autogrowth
File Growth
In Percent
10
In Megabytes
64
Maximum File Size
Limited to (MB)
1,024
Unlimited
OK
Cancel

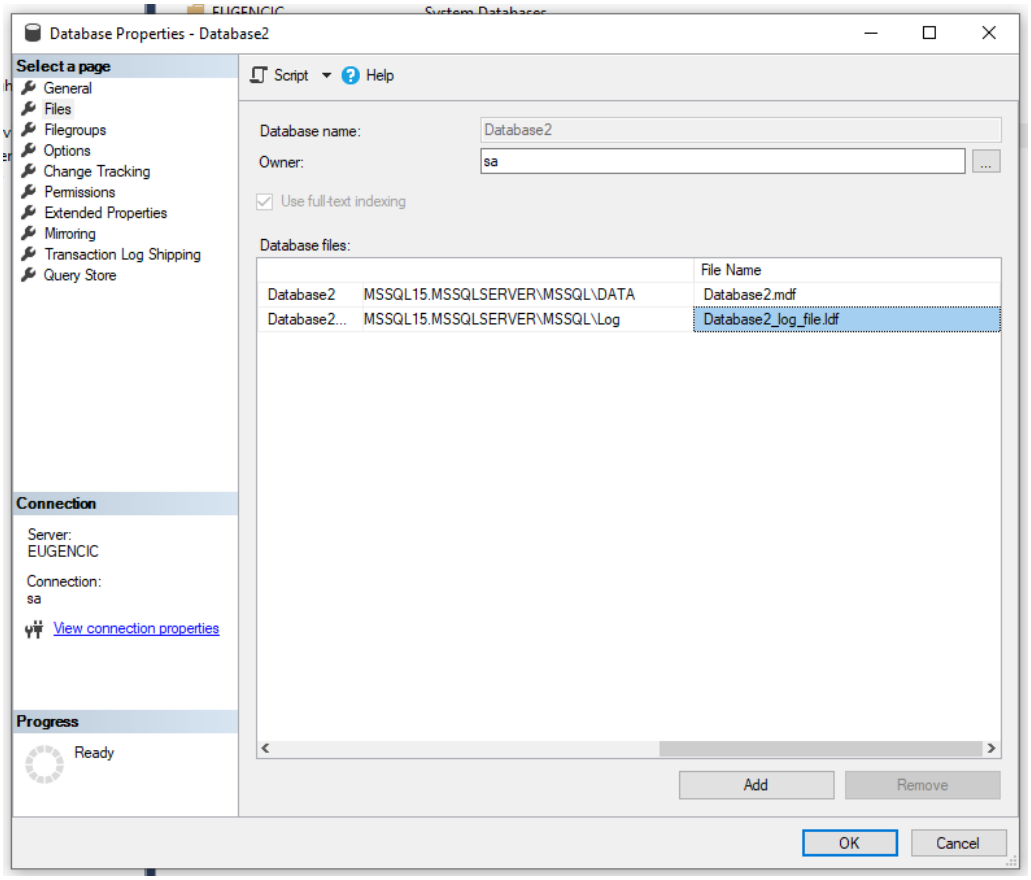

New Database
Select a page
General
Options
Filegroups
Script
Help
Rows
Name
Files
Read-Only
Default
Autogrow All Files
PRIMARY
1
Secondary
0
Add Filegroup
Remove
FILESTREAM
Name
FILESTREAM Files
Read-Only
Default
Add Filegroup
Remove
MEMORY OPTIMIZED DATA
Name
FILESTREAM Files
Add Filegroup
Remove
Connection
Server:
EUGENCIC
Connection:
sa
View connection properties
Progress
Ready
OK
Cancel

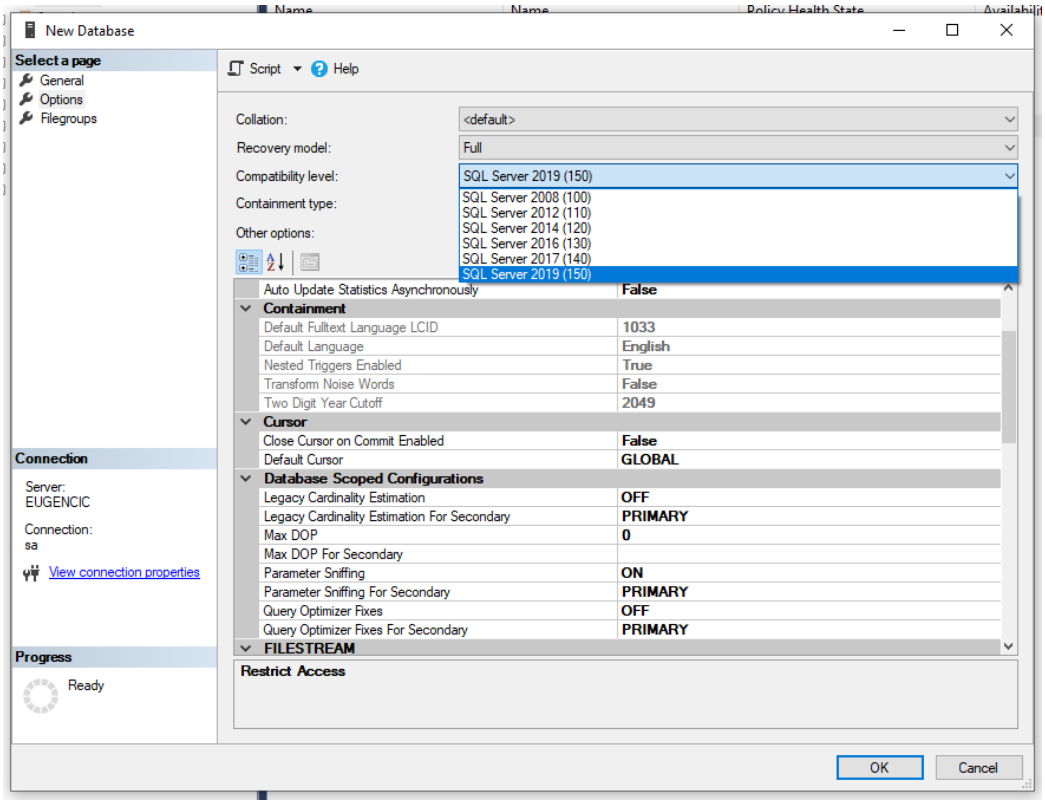

Change Autogrowth for Secondary file
Enable Autogrowth
File Growth
In Percent
10
In Megabytes
64
Maximum File Size
Limited to (MB)
1,024
Unlimited
OK
Cancel

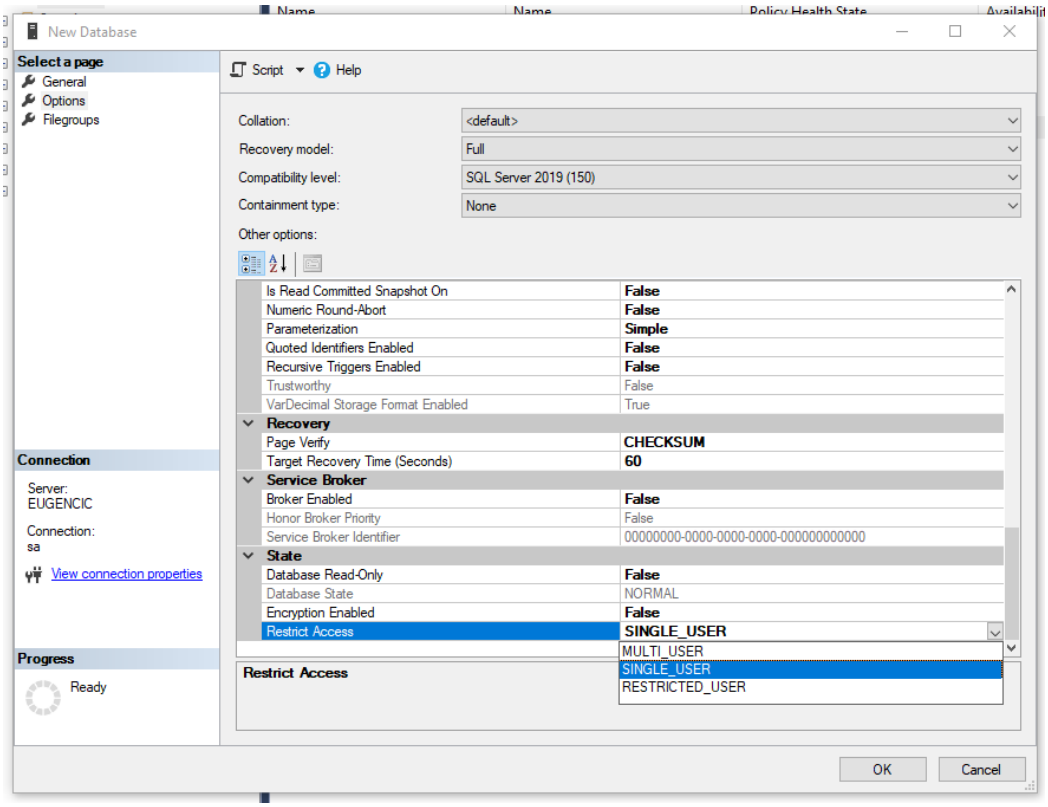

EUGENCIC (SQL Server 15.0.2080.9 - sa)\Databases
New Database
Select a page
General
Options
Filegroups
Script
Help
Database name:
Database1
Owner:
<default>
Use full-text indexing
Database files:
Logical Name
File Type
Filegroup
Initial Size (MB)
Autogrowth / Maxsize
Database1
ROWS...
PRIMARY
8
By 16 MB, Limited to 1...
Database1...
LOG
Not Applicable
8
By 64 MB, Limited to 1...
Secondary f...
ROWS...
Secondary
8
By 64 MB, Limited to 1...
Add
Remove
Connection
Server:
EUGENCIC
Connection:
sa
View connection properties
Progress
Ready
OK
Cancel

2. Create a database, where the log file is physically placed in the MyDocuments \ Log folder, name the log file in the operating system environment must differ from the logical one defined in physical scheme. It is important that the database created is compatible with the MS SQL Server 2019 system and it should be accessible to only one user at a time.

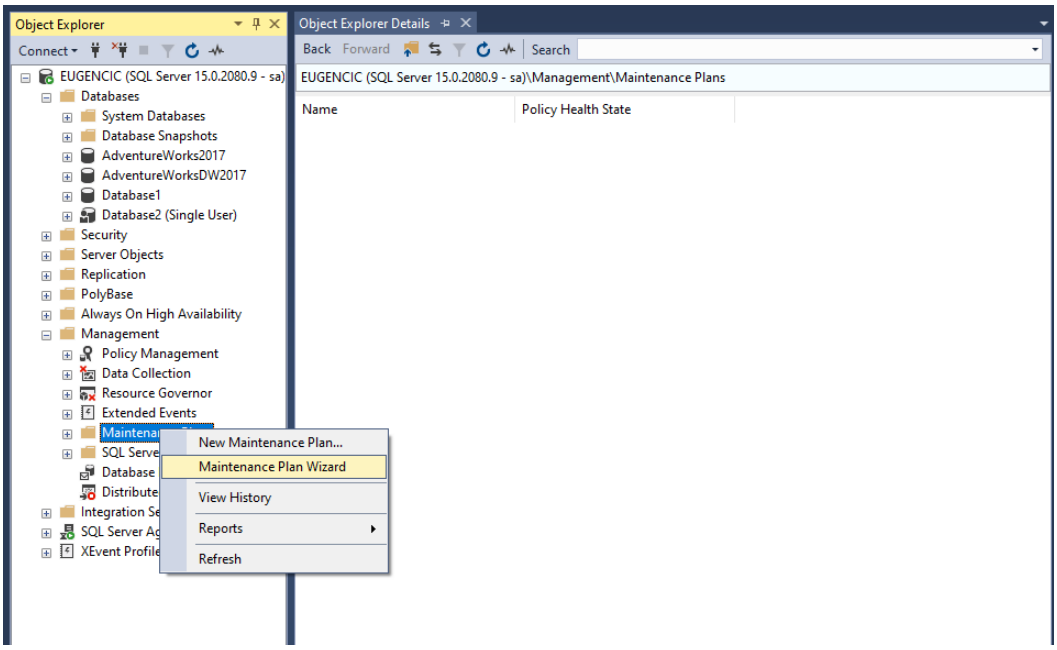


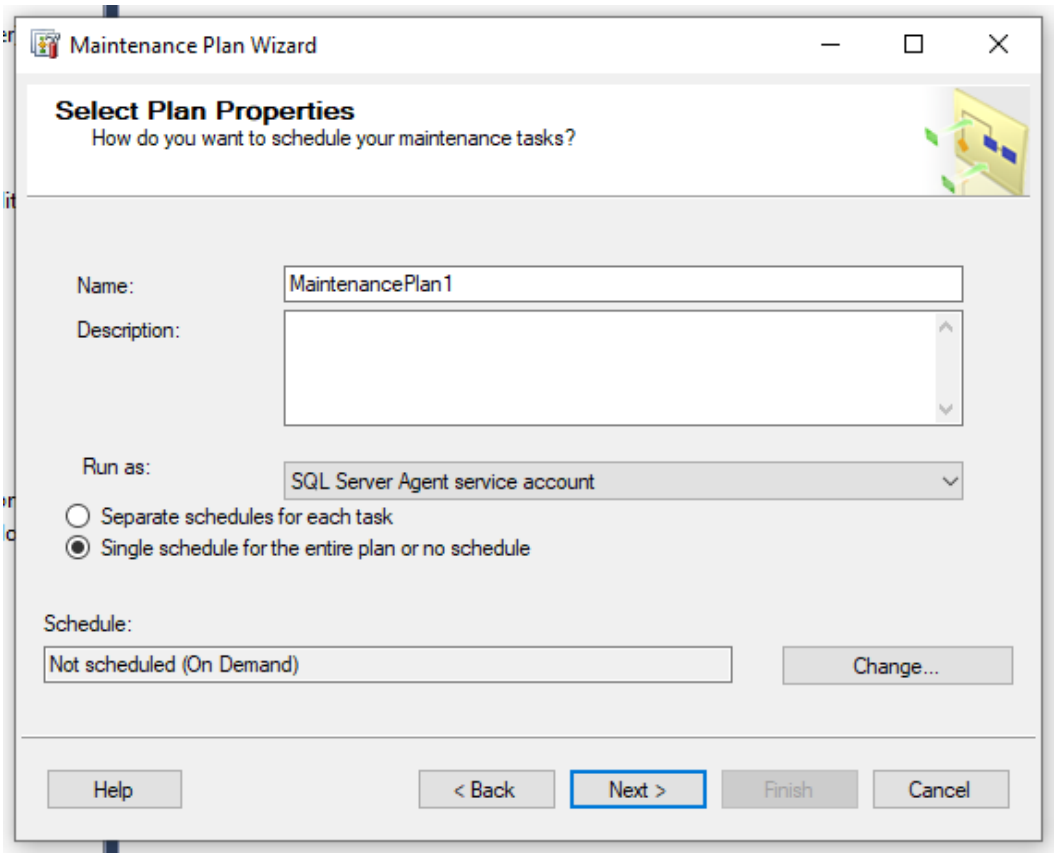


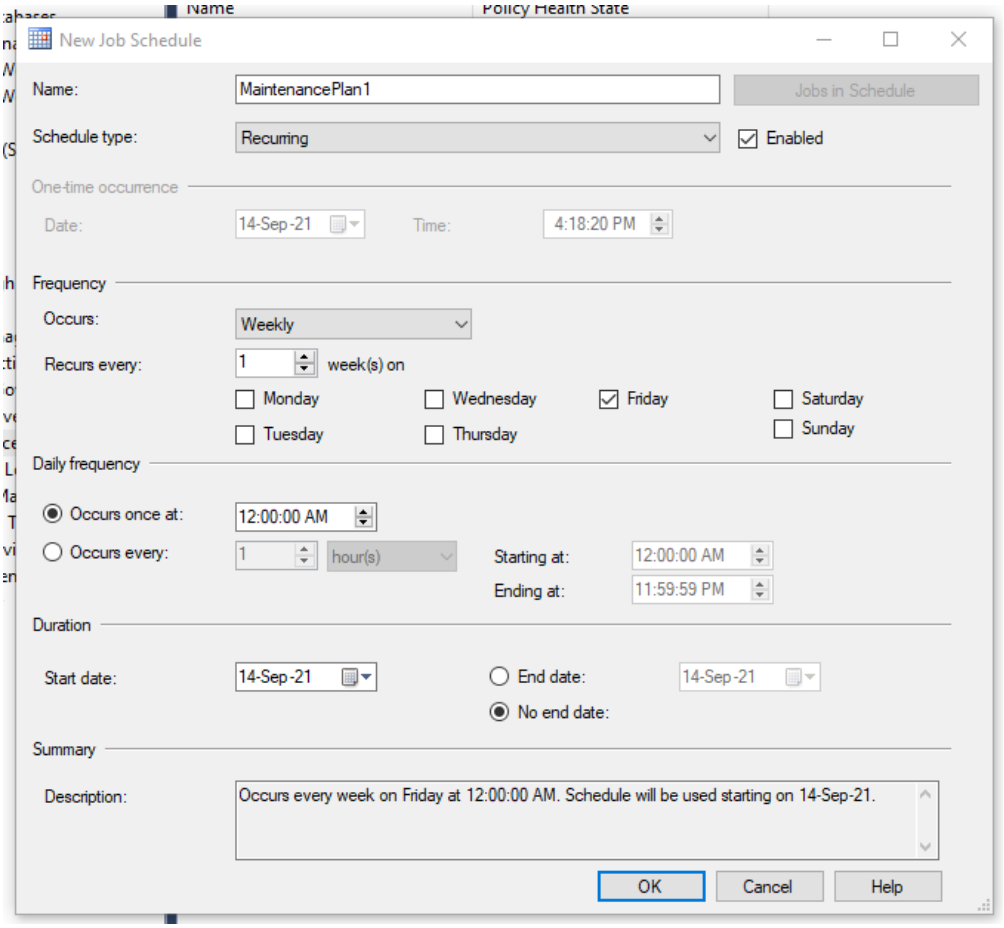

New Database
Select a page
General
Options
Filegroups
Script
Help
Collation:
<default>
Recovery model:
Full
Compatibility level:
SQL Server 2019 (150)
Containment type:
Other options:
SQL Server 2008 (100)
SQL Server 2012 (110)
SQL Server 2014 (120)
SQL Server 2016 (130)
SQL Server 2017 (140)
SQL Server 2019 (150)
Auto Update Statistics Asynchronously
False
Containment
Default Fulltext Language LCID
1033
Default Language
English
Nested Triggers Enabled
True
Transform Noise Words
False
Two Digit Year Cutoff
2049
Cursor
Close Cursor on Commit Enabled
False
Default Cursor
GLOBAL
Database Scoped Configurations
Legacy Cardinality Estimation
OFF
Legacy Cardinality Estimation For Secondary
PRIMARY
Max DOP
0
Max DOP For Secondary
Parameter Sniffing
ON
Parameter Sniffing For Secondary
PRIMARY
Query Optimizer Fixes
OFF
Query Optimizer Fixes For Secondary
PRIMARY
FILESTREAM
Restrict Access
Connection
Server:
EUGENCIC
Connection:
sa
View connection properties
Progress
Ready
OK
Cancel

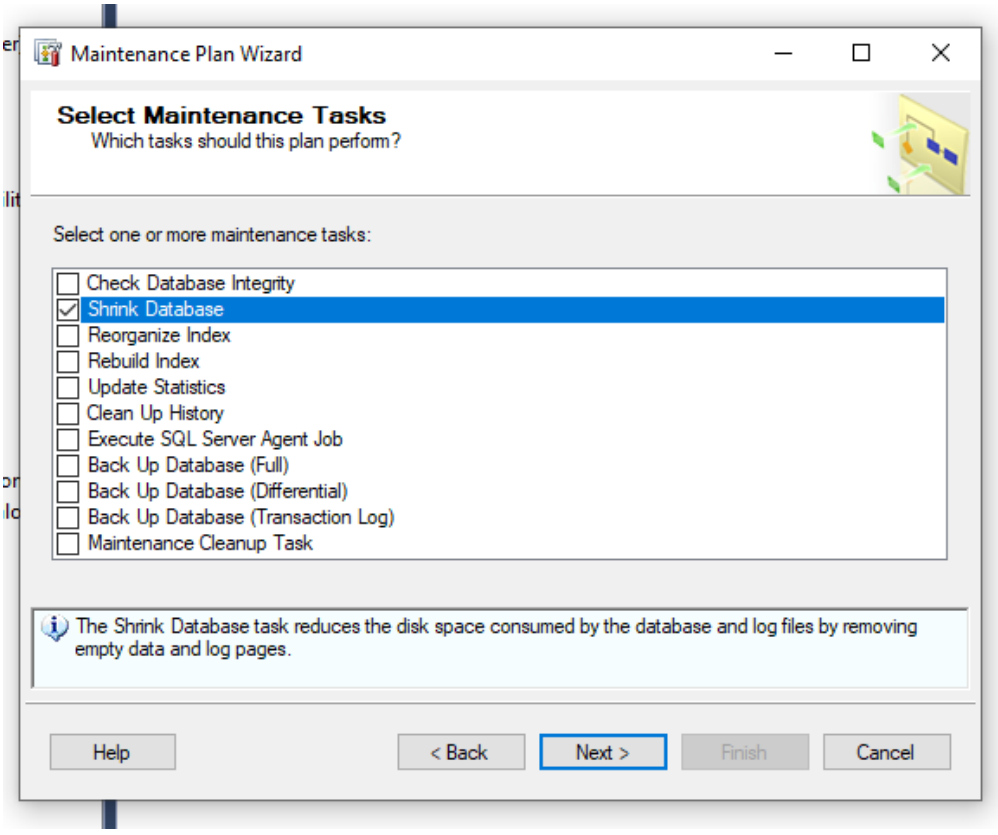

New Database
Select a page
General
Options
Filegroups
Script
Help
Collation:
<default>
Recovery model:
Full
Compatibility level:
SQL Server 2019 (150)
Containment type:
None
Other options:
Is Read Committed Snapshot On
False
Numeric Round-Abort
False
Parameterization
Simple
Quoted Identifiers Enabled
False
Recursive Triggers Enabled
False
Trustworthy
False
VarDecimal Storage Format Enabled
True
Recovery
Page Verify
CHECKSUM
Target Recovery Time (Seconds)
60
Service Broker
Broker Enabled
False
Honor Broker Priority
False
Service Broker Identifier
00000000-0000-0000-0000-000000000000
State
Database Read-Only
False
Database State
NORMAL
Encryption Enabled
False
Restrict Access
SINGLE_USER
MULTI_USER
SINGLE_USER
RESTRICTED_USER
Restrict Access
Connection
Server:
EUGENCIC
Connection:
sa
View connection properties
Progress
Ready
OK
Cancel

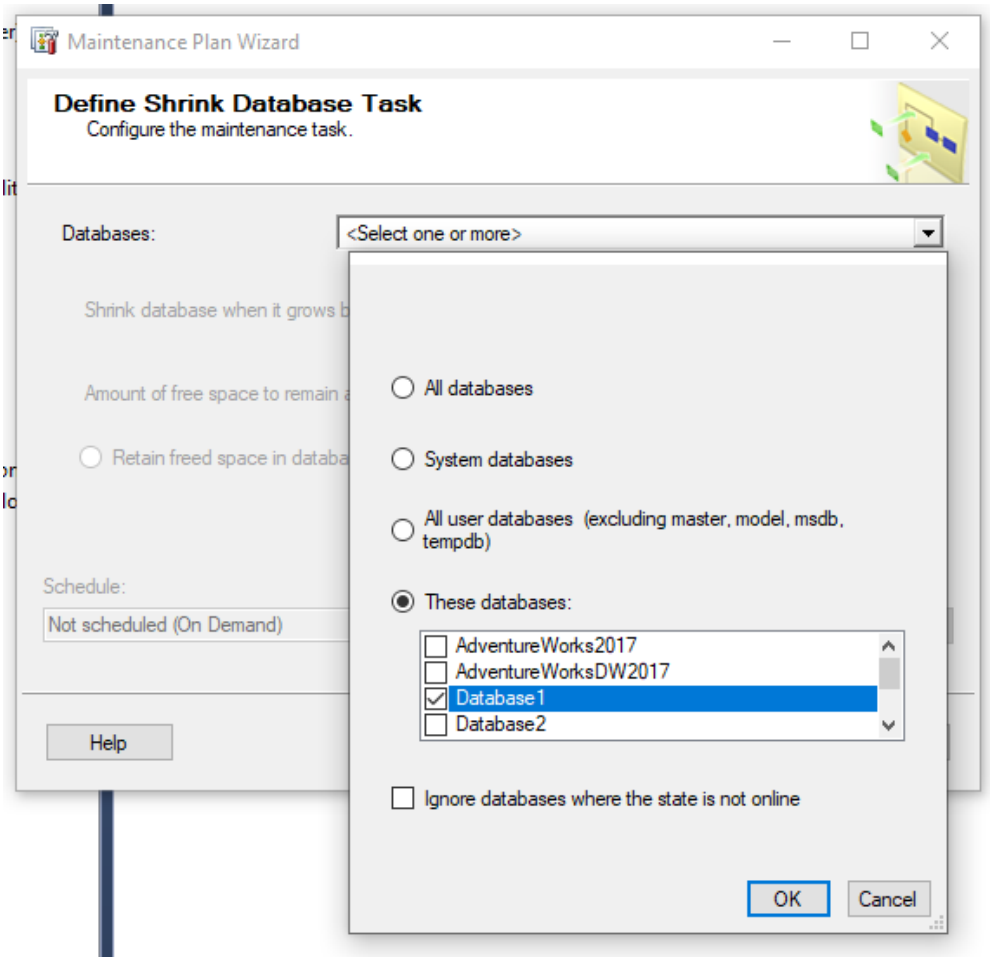
3. Create the database maintenance plan, built in task 1. Unused space by the database files must be removed when it reaches the size 2000Mb. Released space must be returned to the operating system. This operation must run every Friday at 00:00. The maintenance plan execution report must be saved to the file MyDocuments \ SQL_event_logs. Initialize the execution of the plan. After execution, check results in the log file.

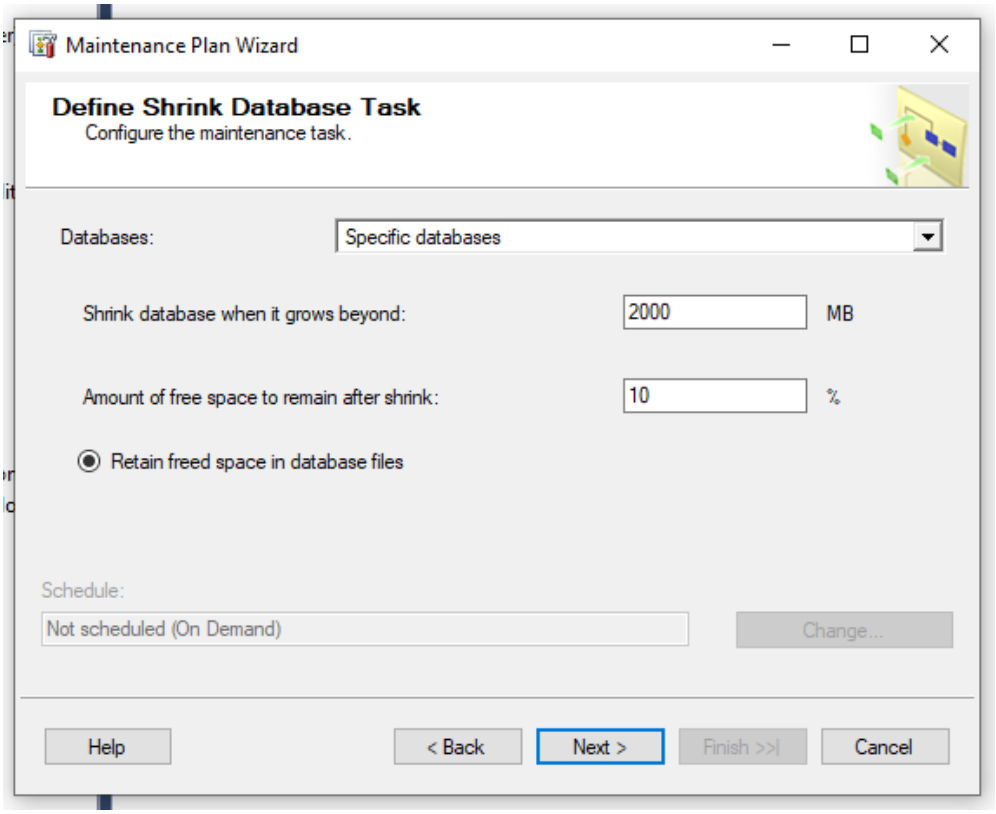


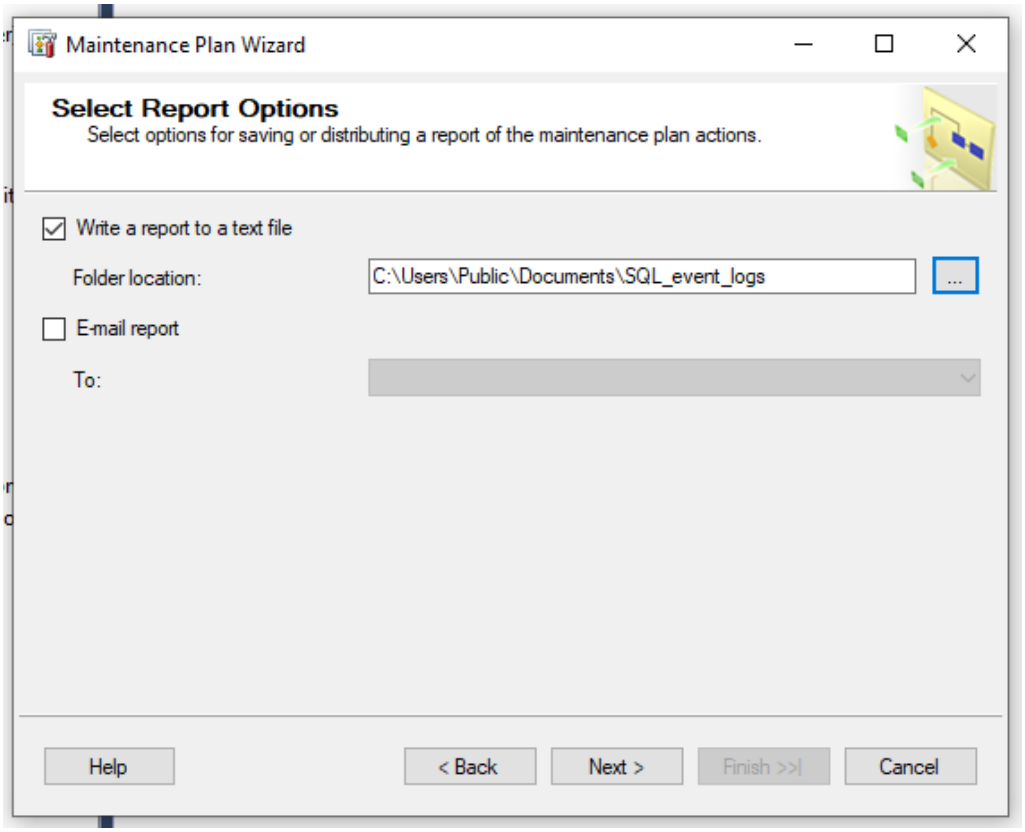


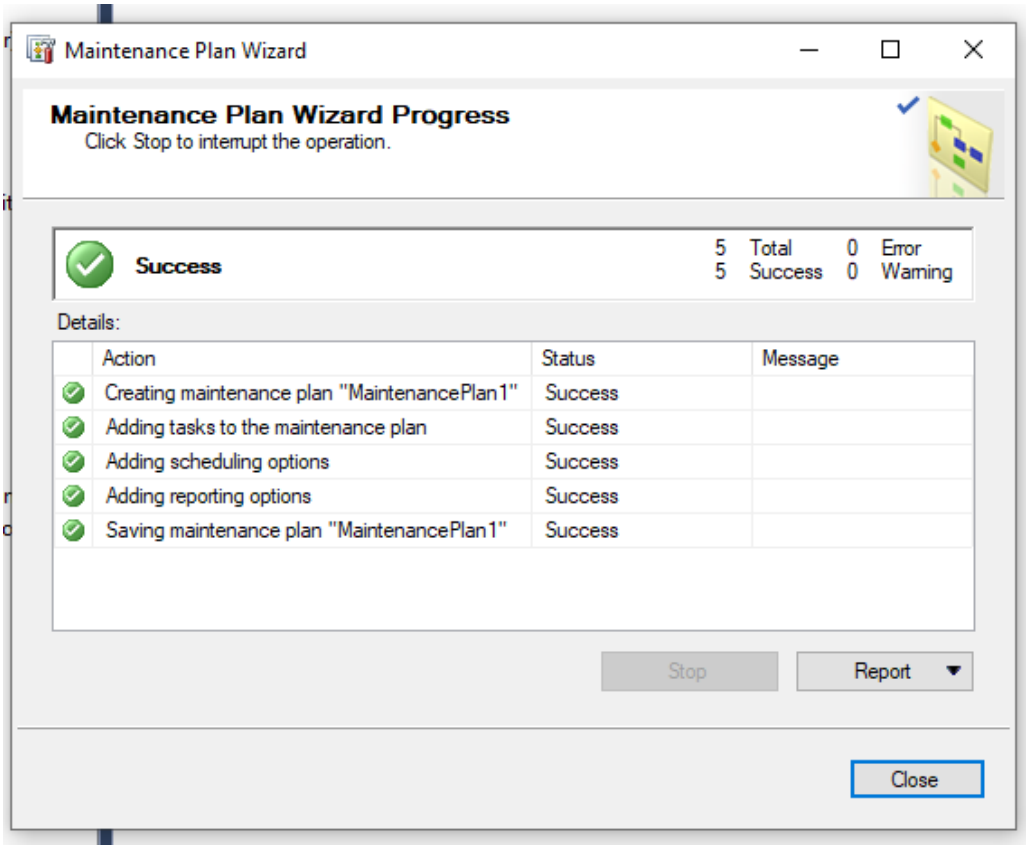

Name
Policy Health State
New Job Schedule
Name:
MaintenancePlan1
Jobs in Schedule
Schedule type:
Recurring
Enabled
One-time occurrence
Date:
14-Sep-21
Time:
4:18:20 PM
Frequency
Occurs:
Weekly
Recurs every:
1
week(s) on
Monday
Wednesday
Friday
Saturday
Tuesday
Thursday
Sunday
Daily frequency
Occurs once at:
12:00:00 AM
Occurs every:
1
hour(s)
Starting at:
12:00:00 AM
Ending at:
11:59:59 PM
Duration
Start date:
14-Sep-21
End date:
14-Sep-21
No end date:
Summary
Description:
Occurs every week on Friday at 12:00:00 AM. Schedule will be used starting on 14-Sep-21.
OK
Cancel
Help

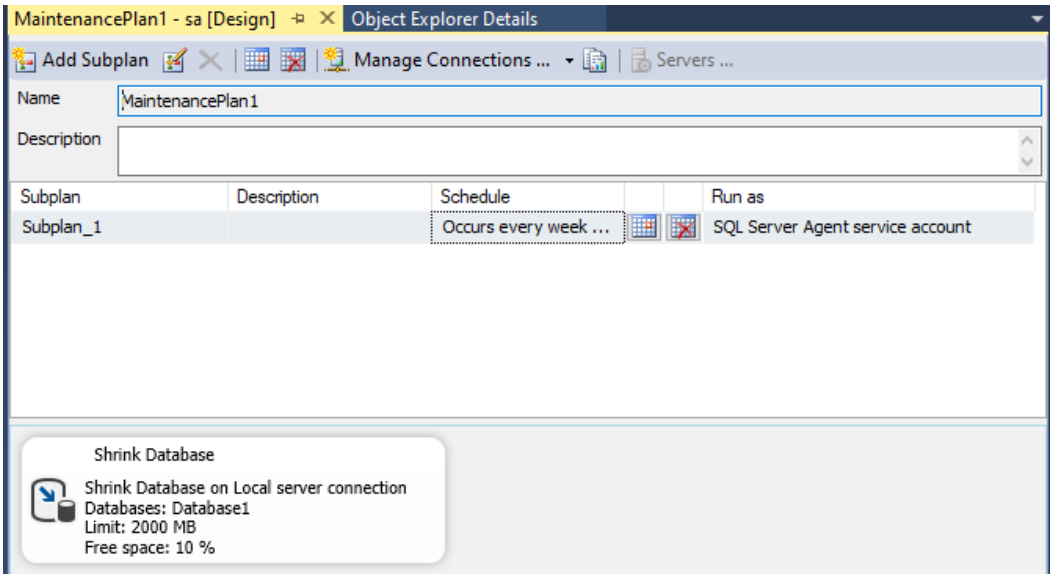

Maintenance Plan Wizard
Select Maintenance Tasks
Which tasks should this plan perform?
Select one or more maintenance tasks:
Check Database Integrity
Shrink Database
Reorganize Index
Rebuild Index
Update Statistics
Clean Up History
Execute SQL Server Agent Job
Back Up Database (Full)
Back Up Database (Differential)
Back Up Database (Transaction Log)
Maintenance Cleanup Task
The Shrink Database task reduces the disk space consumed by the database and log files by removing empty data and log pages.
Help
< Back
Next >
Finish
Cancel


Maintenance Plan Wizard
Define Shrink Database Task
Configure the maintenance task.
Databases:
<Select one or more>
Shrink database when it grows b
Amount of free space to remain a
Retain freed space in databa
Schedule:
Not scheduled (On Demand)
Help
All databases
System databases
All user databases (excluding master, model, msdb, tempdb)
These databases:
AdventureWorks2017
AdventureWorksDW2017
Database1
Database2
Ignore databases where the state is not online
OK
Cancel

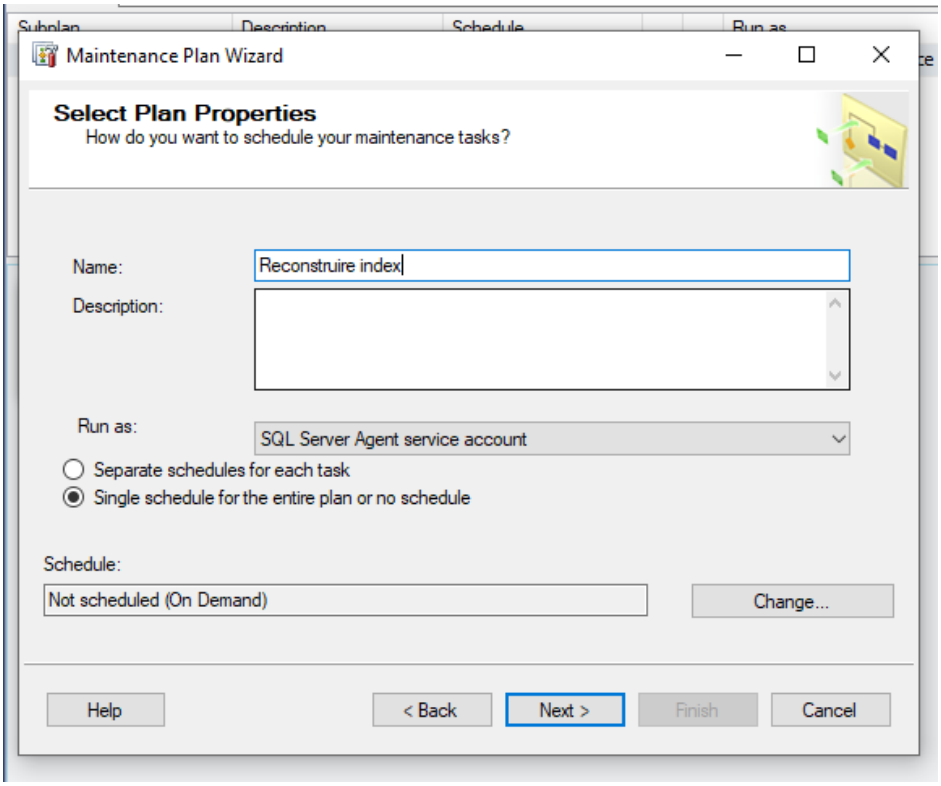

Maintenance Plan Wizard
Define Shrink Database Task
Configure the maintenance task.
Databases:
Specific databases
Shrink database when it grows beyond:
2000
MB
Amount of free space to remain after shrink:
10
%
Retain freed space in database files
Schedule:
Not scheduled (On Demand)
Change...
Help
< Back
Next >
Finish >>|
Cancel

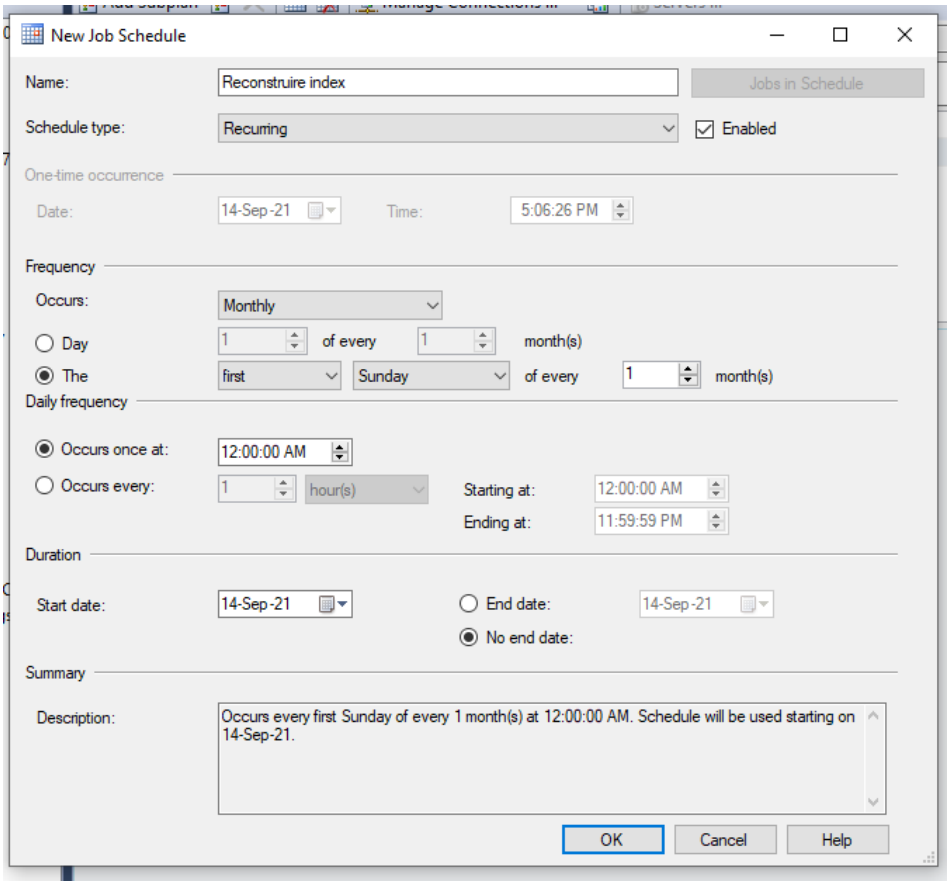

Maintenance Plan Wizard
Select Report Options
Select options for saving or distributing a report of the maintenance plan actions.
Write a report to a text file
Folder location:
C:\Users\Public\Documents\SQL_event_logs
...
E-mail report
To:
Help
< Back
Next >
Finish >>|
Cancel

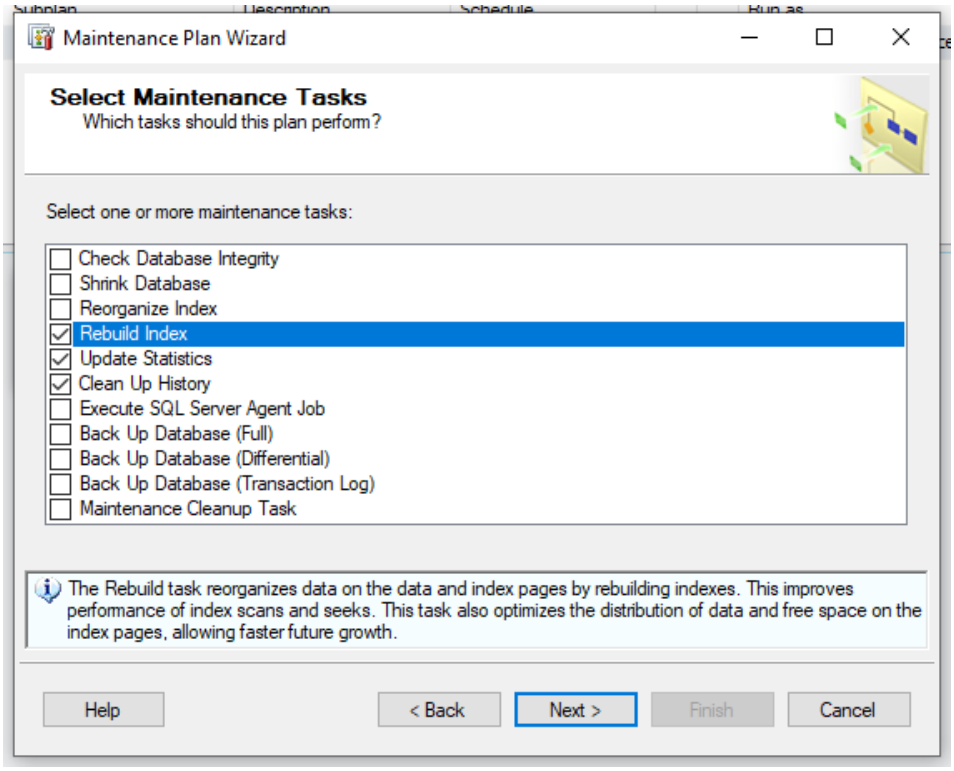

Maintenance Plan Wizard
Maintenance Plan Wizard Progress
Click Stop to interrupt the operation.
Success
5 Total
5 Success
0 Error
0 Warning
Details:
Action
Status
Message
Creating maintenance plan "MaintenancePlan1"
Success
Adding tasks to the maintenance plan
Success
Adding scheduling options
Success
Adding reporting options
Success
Saving maintenance plan "MaintenancePlan1"
Success
Stop
Report
Close

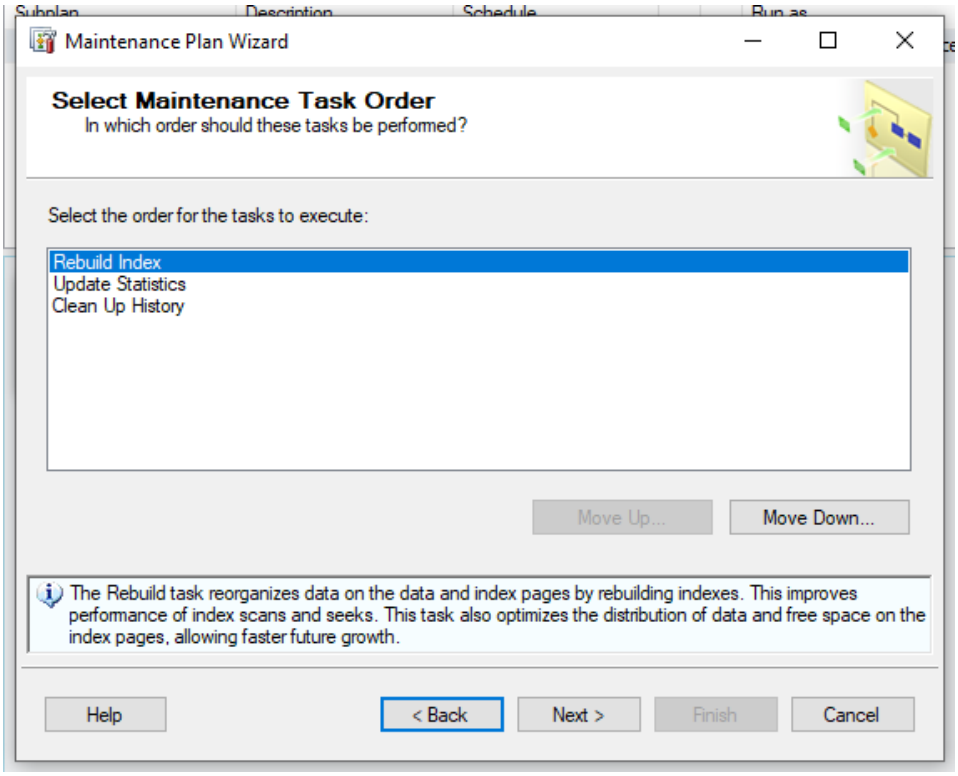


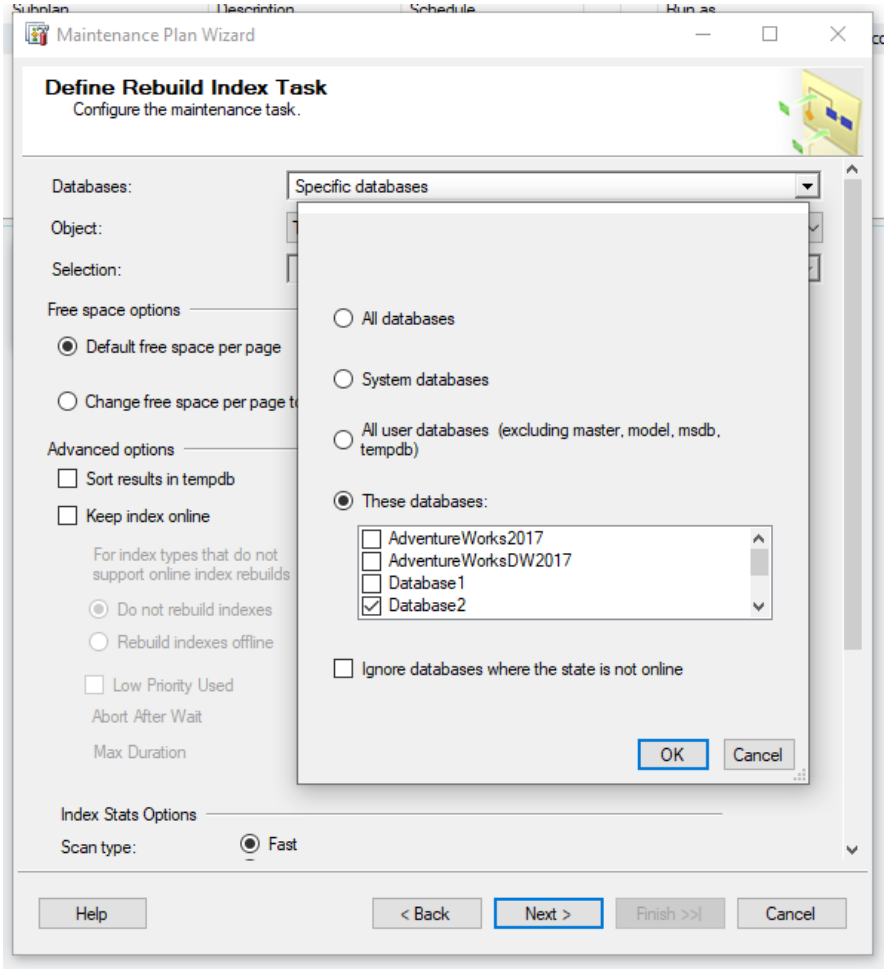
4. Create the database maintenance plan, built in exercise 2. The name of the plan will be: "Reconstruire index". In this plan, the system must perform the reconstruction indexes only on the basic tables (excluding visions) from all existing schemes in the database in cause. The free space on the page must be 10%. Sorting indexes must be realized in tempdb. After the reconstruction, the collection of statistics must follow complete about reconstructed indexes. The third step of the plan should be the task of clear history of Backup-Restore operations on SQL Server. Must be deleted the history that is older than 6 weeks. This plan must be executed in each the first Sunday of the month. Create the MyDocuments \ SQL reports folder. Execution report of plan must be added to this file. Maintenance process - to be logged in extended. Initialize the execution of the plan. After execution, check the results in the log file generated.

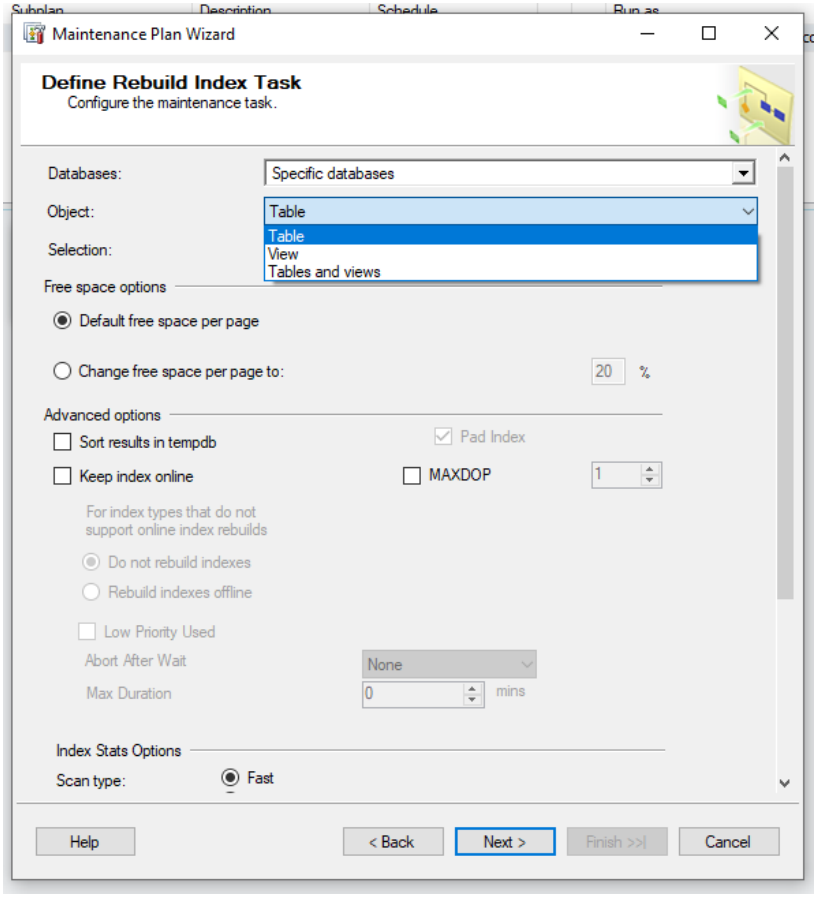


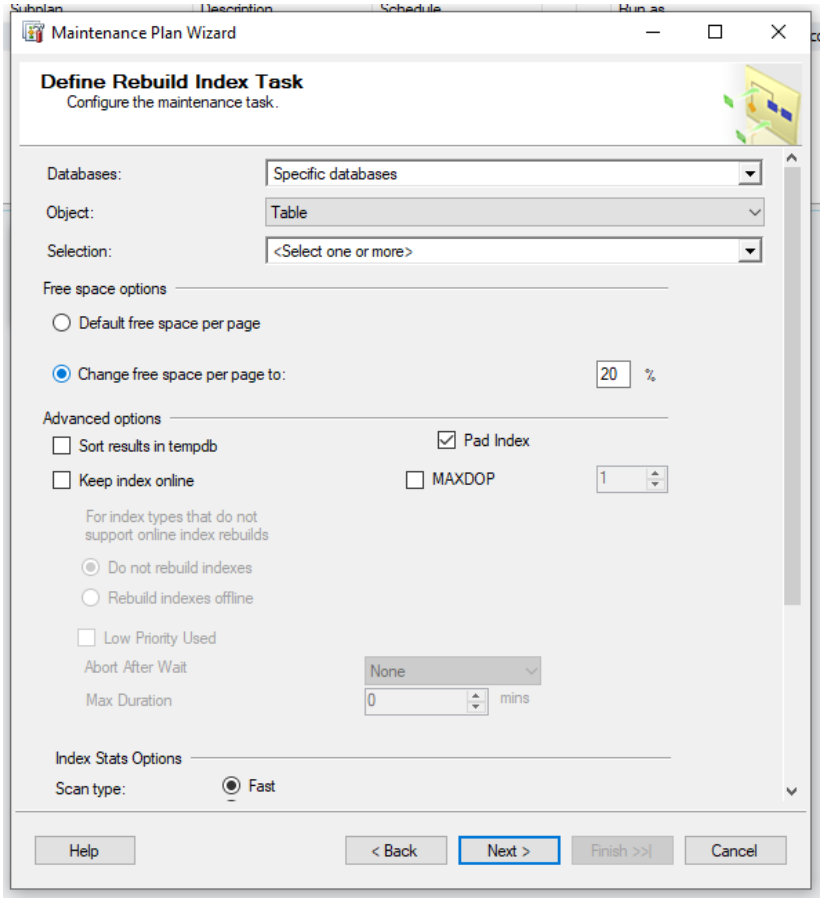

New Job Schedule
Name:
Reconstruire index
Jobs in Schedule
Schedule type:
Recurring
Enabled
One-time occurrence
Date:
14-Sep-21
Time:
5:06:26 PM
Frequency
Occurs:
Monthly
Day
1
of every
1
month(s)
The
first
Sunday
of every
1
month(s)
Daily frequency
Occurs once at:
12:00:00 AM
Occurs every:
1
hour(s)
Starting at:
12:00:00 AM
Ending at:
11:59:59 PM
Duration
Start date:
14-Sep-21
End date:
14-Sep-21
No end date:
Summary
Description:
Occurs every first Sunday of every 1 month(s) at 12:00:00 AM. Schedule will be used starting on 14-Sep-21.
OK
Cancel
Help

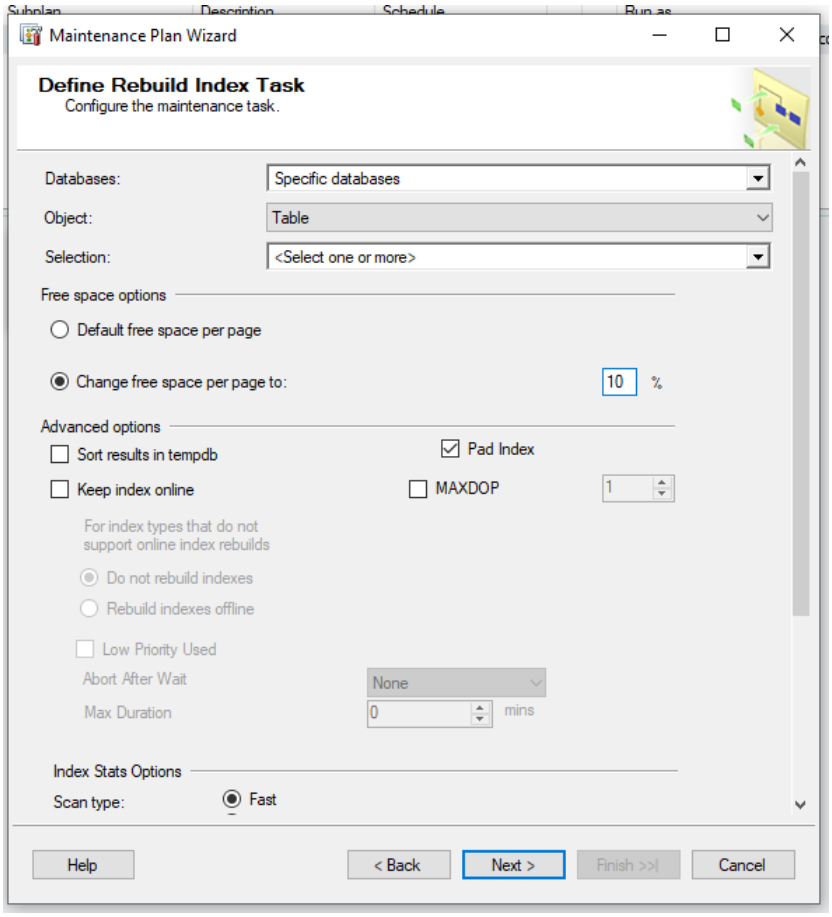

Maintenance Plan Wizard
Select Maintenance Tasks
Which tasks should this plan perform?
Select one or more maintenance tasks:
Check Database Integrity
Shrink Database
Reorganize Index
Rebuild Index
Update Statistics
Clean Up History
Execute SQL Server Agent Job
Back Up Database (Full)
Back Up Database (Differential)
Back Up Database (Transaction Log)
Maintenance Cleanup Task
The Rebuild task reorganizes data on the data and index pages by rebuilding indexes. This improves performance of index scans and seeks. This task also optimizes the distribution of data and free space on the index pages, allowing faster future growth.
Help
< Back
Next >
Finish
Cancel

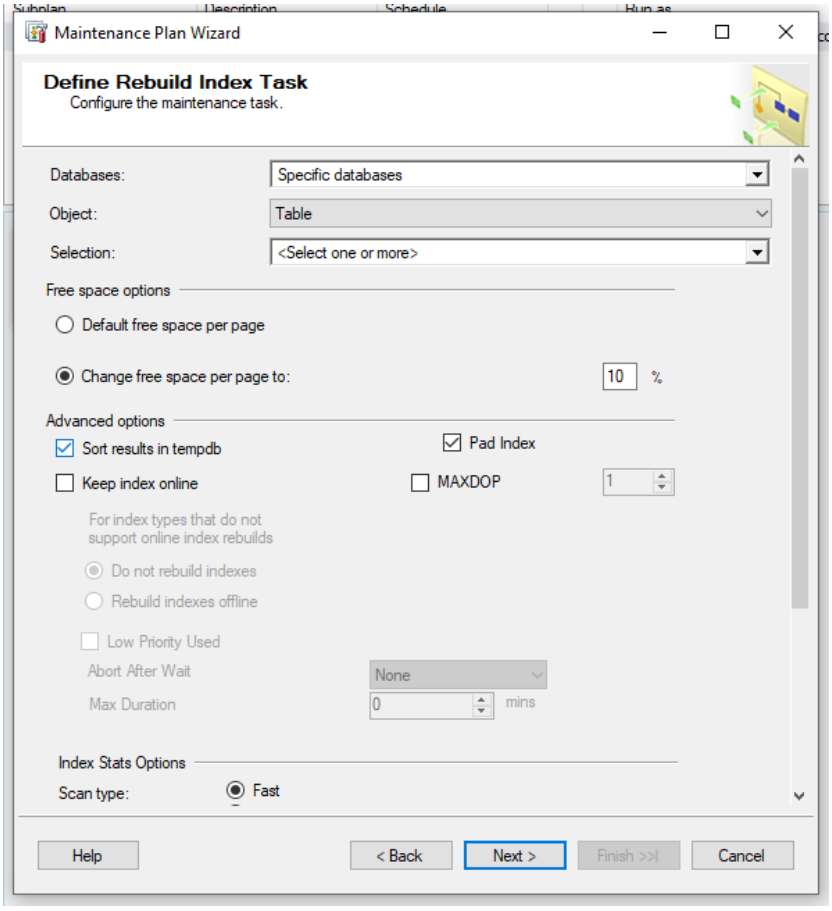

Maintenance Plan Wizard
Select Maintenance Task Order
In which order should these tasks be performed?
Select the order for the tasks to execute:
Rebuild Index
Update Statistics
Clean Up History
Move Up...
Move Down...
The Rebuild task reorganizes data on the data and index pages by rebuilding indexes. This improves performance of index scans and seeks. This task also optimizes the distribution of data and free space on the index pages, allowing faster future growth.
Help
< Back
Next >
Finish
Cancel

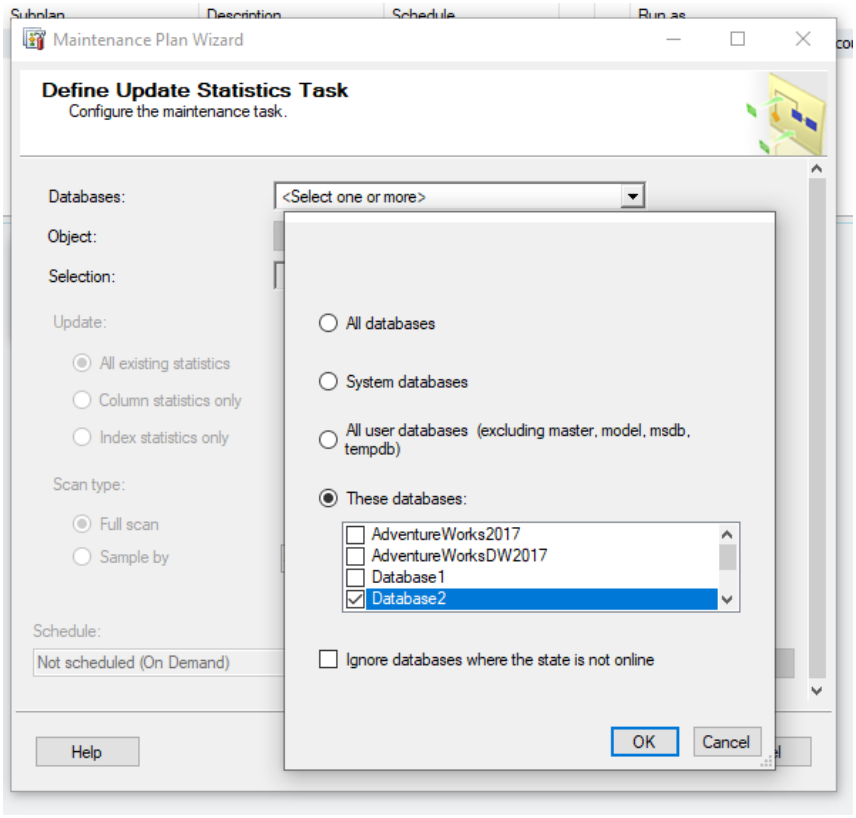

Maintenance Plan Wizard
Define Rebuild Index Task
Configure the maintenance task.
Databases:
Specific databases
Object:
Selection:
Free space options
Default free space per page
Change free space per page t
Advanced options
Sort results in tempdb
Keep index online
For index types that do not support online index rebuilds
Do not rebuild indexes
Rebuild indexes offline
Low Priority Used
Abort After Wait
Max Duration
All databases
System databases
All user databases (excluding master, model, msdb, tempdb)
These databases:
AdventureWorks2017
AdventureWorksDW2017
Database1
Database2
Ignore databases where the state is not online
OK
Cancel
Index Stats Options
Scan type:
Fast
Help
< Back
Next >
Finish >>|
Cancel

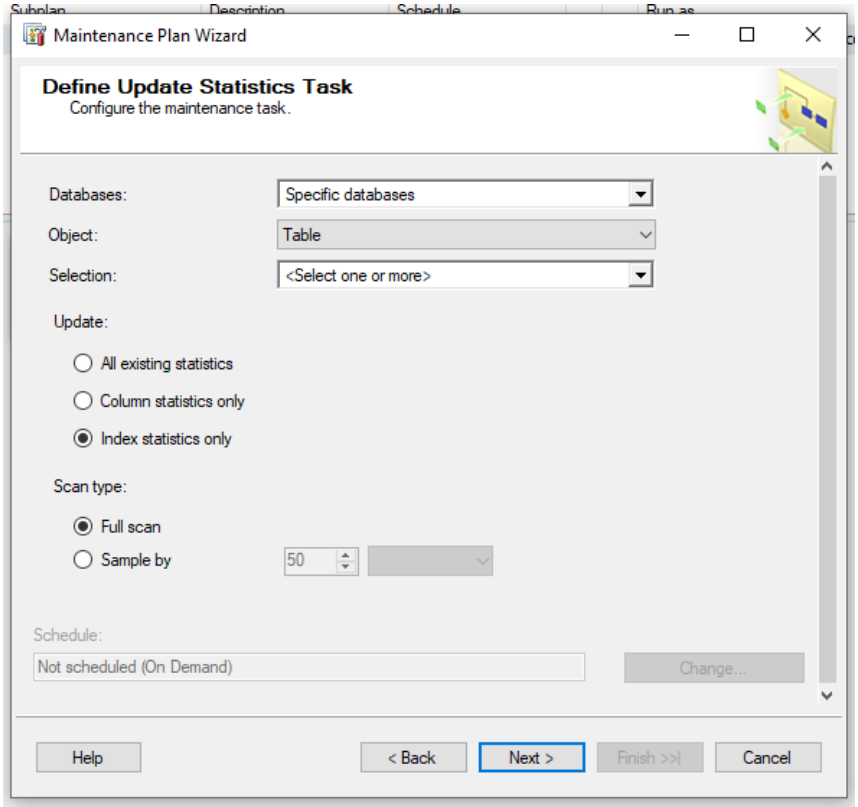

Maintenance Plan Wizard
Define Rebuild Index Task
Configure the maintenance task.
Databases:
Specific databases
Object:
Table
Table
View
Tables and views
Selection:
Free space options
Default free space per page
Change free space per page to:
20
%
Advanced options
Sort results in tempdb
Pad Index
Keep index online
MAXDOP
1
For index types that do not support online index rebuilds
Do not rebuild indexes
Rebuild indexes offline
Low Priority Used
Abort After Wait
None
Max Duration
0
mins
Index Stats Options
Scan type:
Fast
Help
< Back
Next >
Finish >>|
Cancel

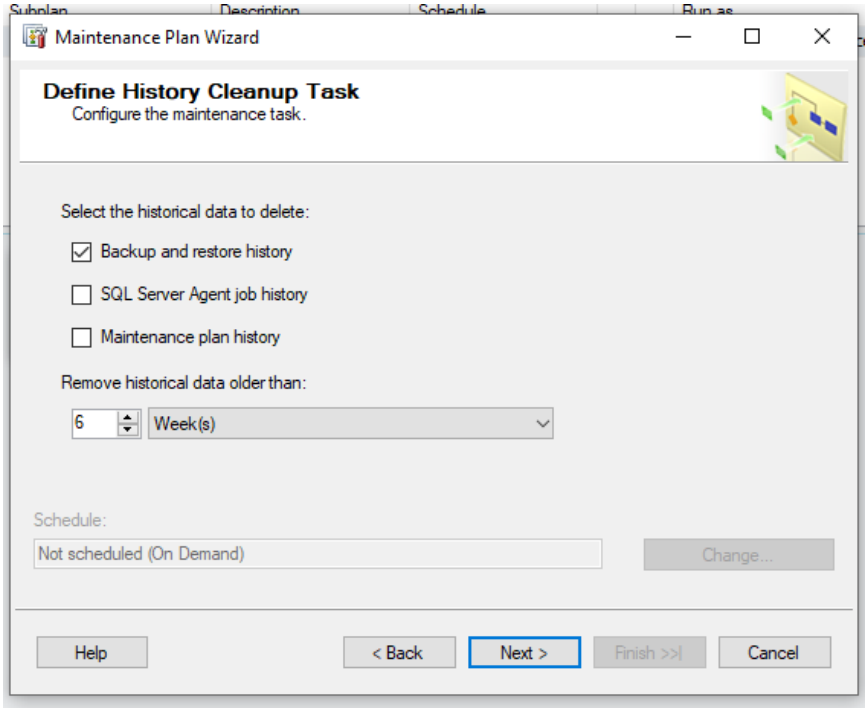

Maintenance Plan Wizard
Define Rebuild Index Task
Configure the maintenance task.
Databases:
Specific databases
Object:
Table
Selection:
<Select one or more>
Free space options
Default free space per page
Change free space per page to:
20
%
Advanced options
Sort results in tempdb
Pad Index
Keep index online
MAXDOP
1
For index types that do not support online index rebuilds
Do not rebuild indexes
Rebuild indexes offline
Low Priority Used
Abort After Wait
None
Max Duration
0
mins
Index Stats Options
Scan type:
Fast
Help
< Back
Next >
Finish >>|
Cancel

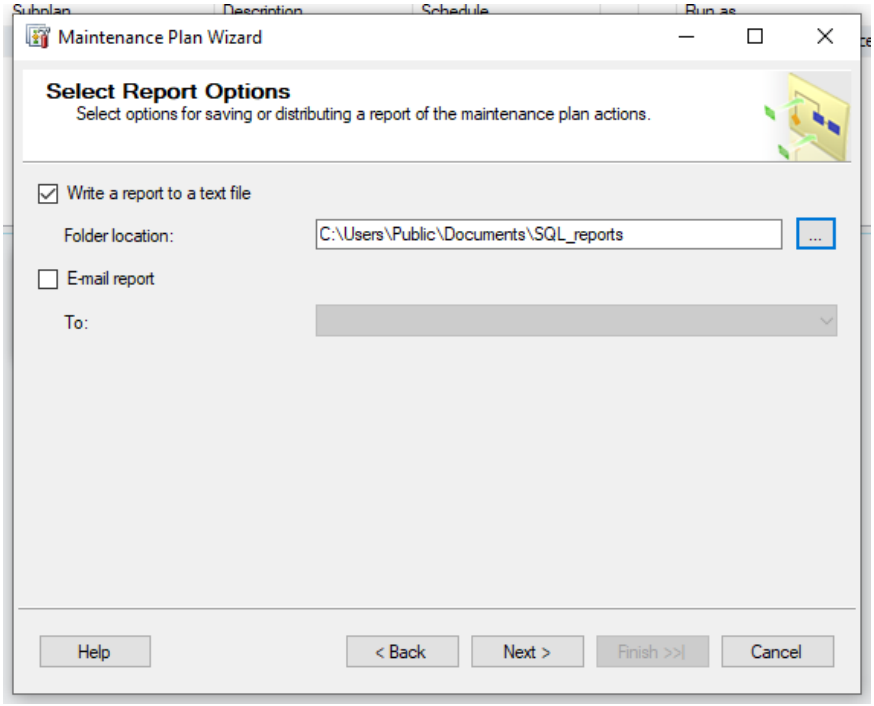

Maintenance Plan Wizard
Define Rebuild Index Task
Configure the maintenance task.
Databases:
Specific databases
Object:
Table
Selection:
<Select one or more>
Free space options
Default free space per page
Change free space per page to:
10
%
Advanced options
Sort results in tempdb
Pad Index
Keep index online
MAXDOP
1
For index types that do not support online index rebuilds
Do not rebuild indexes
Rebuild indexes offline
Low Priority Used
Abort After Wait
None
Max Duration
0
mins
Index Stats Options
Scan type:
Fast
Help
< Back
Next >
Finish >>|
Cancel

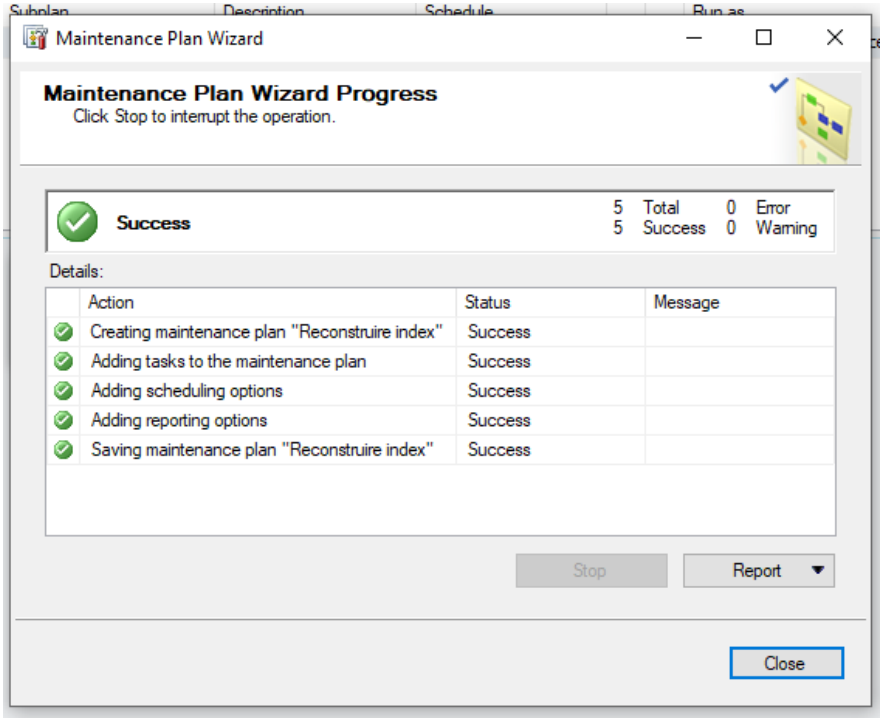

Maintenance Plan Wizard
Define Rebuild Index Task
Configure the maintenance task.
Databases:
Specific databases
Object:
Table
Selection:
<Select one or more>
Free space options
Default free space per page
Change free space per page to:
10
%
Advanced options
Sort results in tempdb
Pad Index
Keep index online
MAXDOP
1
For index types that do not support online index rebuilds
Do not rebuild indexes
Rebuild indexes offline
Low Priority Used
Abort After Wait
None
Max Duration
0
mins
Index Stats Options
Scan type:
Fast
Help
< Back
Next >
Finish >>|
Cancel

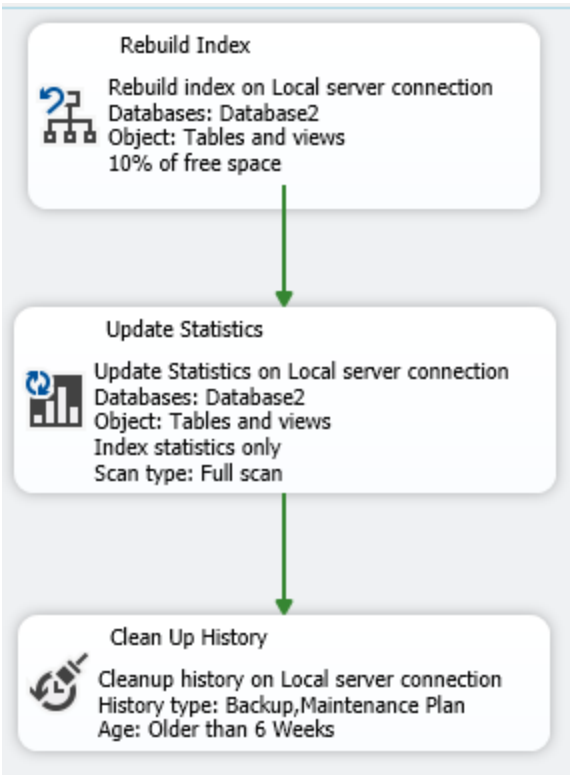

Maintenance Plan Wizard
Define Update Statistics Task
Configure the maintenance task.
Databases:
<Select one or more>
Object:
Selection:
Update:
All existing statistics
Column statistics only
Index statistics only
Scan type:
Full scan
Sample by
Schedule:
Not scheduled (On Demand)
Help
All databases
System databases
All user databases (excluding master, model, msdb, tempdb)
These databases:
AdventureWorks2017
AdventureWorksDW2017
Database1
Database2
Ignore databases where the state is not online
OK
Cancel


Maintenance Plan Wizard
Define Update Statistics Task
Configure the maintenance task.
Databases:
Specific databases
Object:
Table
Selection:
<Select one or more>
Update:
All existing statistics
Column statistics only
Index statistics only
Scan type:
Full scan
Sample by
50
Schedule:
Not scheduled (On Demand)
Change...
Help
< Back
Next >
Finish >>|
Cancel


Maintenance Plan Wizard
Define History Cleanup Task
Configure the maintenance task.
Select the historical data to delete:
Backup and restore history
SQL Server Agent job history
Maintenance plan history
Remove historical data older than:
6
Week(s)
Schedule:
Not scheduled (On Demand)
Change...
Help
< Back
Next >
Finish >>|
Cancel


Maintenance Plan Wizard
Select Report Options
Select options for saving or distributing a report of the maintenance plan actions.
Write a report to a text file
Folder location:
C:\Users\Public\Documents\SQL_reports
...
E-mail report
To:
Help
< Back
Next >
Finish >>|
Cancel


Maintenance Plan Wizard
Maintenance Plan Wizard Progress
Click Stop to interrupt the operation.
Success
5 Total 0 Error
5 Success 0 Warning
Details:
Action
Status
Message
Creating maintenance plan "Reconstruire index"
Success
Adding tasks to the maintenance plan
Success
Adding scheduling options
Success
Adding reporting options
Success
Saving maintenance plan "Reconstruire index"
Success
Stop
Report
Close


Rebuild Index
Rebuild index on Local server connection
Databases: Database2
Object: Tables and views
10% of free space
Update Statistics
Update Statistics on Local server connection
Databases: Database2
Object: Tables and views
Index statistics only
Scan type: Full scan
Clean Up History
Cleanup history on Local server connection
History type: Backup,Maintenance Plan
Age: Older than 6 Weeks