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# **Best Maintenance Tools for PTC Windchill on Microsoft SQL Server 2005**

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*Production-proven content and process management software*

*Microsoft Corporation  
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## **Abstract**

PTC Windchill is the only Product Lifecycle Management (PLM) solution designed from the ground up to work in an Internet-based, distributed-design environment. Whether you need core product data-management capabilities, optimization of processes to meet industry-specific requirements, or support for global product development, Windchill has the capabilities you need for effective management of global product development teams. Microsoft® SQL Server® provides an ideal database platform for Windchill. With SQL Server as a foundation, Windchill can further reduce the time and costs related to managing product development.

This white paper provides best practices for configuring and running Windchill on the SQL Server database platform. The information in this paper complements the detailed support documentation provided on the PTC support Web site. Implementing these best practices can help you avoid or minimize common problems and optimize the performance of Windchill on SQL Server so that you can effectively manage your resources, reduce operating expenses, increase productivity, and improve employee satisfaction.

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# Overview

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For manufacturers, there is constant pressure today to compete in rapidly changing markets. Companies must be innovative in keeping costs low while maintaining high-quality results. The stakeholders involved in the product development process have also changed. Teams today extend far beyond the central engineering department to include globally dispersed cross-functional groups working on hundreds of products with thousands of parts. The result is an enormous amount of data.

To stay ahead of the global competition, companies find that they must create a collaborative environment that brings together engineering, manufacturing, marketing, and sales teams. Product Lifecycle Management (PLM) solutions can help manufacturers achieve this collaboration, while also streamlining operations and keeping costs down.

PLM is the process of managing all phases of product development—from initial concept through end of life. Effective PLM combines information, methodology, and available resources for each phase of a product's lifecycle, improving a manufacturer's ability to respond swiftly and effectively to changes, new markets, and competitors.

## Introducing PTC Windchill: A Complete Solution for PLM

PTC Windchill provides a complete family of solutions for content and process management, helping manufacturers efficiently control all information assets related to product development while optimizing associated business processes. Windchill is the only PLM solution designed from the ground up to work in an Internet-based, distributed-design environment.

Windchill technology forms a solid foundation for a variety of packages that PTC offers to address data, change, configuration, and process management; product development collaboration; project management and execution; and the release of product information to manufacturing management systems. For example,

- **Windchill PDMLink** consolidates scattered islands of product content into a single information source, which can help bring order to chaotic product development processes such as change management and speed the development of new product configurations.
- **Windchill ProjectLink** creates a virtual workspace that becomes the central access point for a project, enabling team members to collaborate with access to the same information. By automating project management activities, Windchill ProjectLink helps customers better manage all of their programs, project schedules, information, and processes.

As an integral component of PTC's Product Development System (PDS), Windchill manages all product content and business processes throughout a product's lifecycle. Windchill connects seamlessly to Pro/ENGINEER for three-dimensional (3-D) computer-aided design (CAD) models, ProductView® for advanced mock-up and interactive visualization, Mathcad® for engineering calculations, and Arbortext® for dynamic publishing.

## **SQL Server: An Enterprise-Ready Database Platform for Windchill**

Microsoft SQL Server provides an ideal database platform for Windchill. SQL Server is a high-performance, integrated database and business intelligence (BI) solution for data management and analysis. This easy-to-implement, easy-to-support foundation provides a multifunctional solution for large-scale online transaction processing (OLTP), data warehousing, and e-commerce applications and a solution for data integration, analysis, and reporting.

SQL Server can help companies manage large volumes of mission-critical data and run software applications—such as PTC Windchill—to optimize their business performance. SQL Server can extract and transform data from a variety of sources, including XML data files, flat files, and relational data sources, and then load it into one or more destinations. In addition to rapid data mining, analysis, processing, and reporting capabilities, SQL Server has built-in features that give you a secure, reliable, and productive data management environment that truly protects your data. With its scalable infrastructure, SQL Server has the capability to grow with your business and keep up with your toughest data challenges.

## **PTC and Microsoft: A History of Innovation**

PTC and Microsoft deliver complementary product development solutions that organizations can use broadly across their infrastructure. With a Microsoft IT infrastructure, you get an open, extensible platform and a simplified user experience. You can take advantage of your existing IT investments for a lower total cost of ownership (TCO). PTC provides full integration with your Microsoft infrastructure, including Microsoft® Office SharePoint® Server, Microsoft® Office Project Server, Microsoft® Office Communications Server, Windows Server®, and SQL Server. The PDS architecture gives you end-to-end solutions for product development and a single source for product and process knowledge.

Together, PTC and Microsoft deliver powerful product development solutions that provide tremendous customer value.

## **Better Together: Windchill on the SQL Server Database Platform**

Running Windchill on SQL Server delivers measureable value by channeling data into manageable, automated processes. This decreases administrative time, improves productivity, reduces costs, and generates greater employee satisfaction. Benchmarking tests confirm that SQL Server scales to meet the performance needs of even the largest enterprise customers, while providing lower initial costs and licensing fees.<sup>1</sup>

Benchmark test results showed that Pro/ENGINEER and Windchill 9.1 performed up to 50 percent faster on SQL Server 2005 than on a competitor's database, with an average performance advantage of approximately 10 percent. These results confirm SQL Server 2005 as a superior database choice for Windchill 9.1.

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<sup>1</sup> "Microsoft SQL Server: Improved Performance for PTC Windchill," [http://www.cio.com/white-paper/588485/Microsoft\\_SQL\\_Server\\_Improved\\_Performance\\_for\\_PTC\\_Windchill](http://www.cio.com/white-paper/588485/Microsoft_SQL_Server_Improved_Performance_for_PTC_Windchill)

# Best Maintenance Tools for Running Windchill on SQL Server

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This paper looks at tools that automate basic best practices described in the companion white paper “Best Practices for PTC Windchill on Microsoft SQL Server,” available on the [Microsoft and PTC Alliance](#) Web page. These tools often provide additional analysis and capabilities not covered in the “Best Practices” white paper.

Best maintenance practices usually include the following aspects:

- Corrective maintenance, such as replacing a suspect or failing drive
- Preventative maintenance, such as backing up databases and storing them off-site
- Predictive maintenance, such as reorganizing files during maintenance windows or adding disks before running out of disk space
- Purchasing, such as ensuring that spares for all critical elements are on site or available from a vendor within an acceptable Service Level Agreement (SLA)
- Proactive maintenance, which is a combination of preventative maintenance and predictive maintenance; an example is looking at the expected upper and lower bounds for growth of data files and users in each budget cycle and obtaining appropriate capital budget for hardware and/or software, such as upgrading a server from SQL Server Standard Edition to Enterprise Edition
- Accountability, such as ensuring that someone is designated and available to deal with issues at all times

Remember that you need to validate best practices using current standards. Best maintenance practices for Windchill on SQL Server 2000 or Oracle may not be recommended or relevant for SQL Server 2005. New software and operating system (OS) patches may also alter the maintenance tasks you need to do.

This white paper focuses on SQL Server performance monitoring, maintaining a healthy database, and maintaining a secure system by using tools provided by Microsoft. For more information about SQL Server administration, see the bibliography at the end of this paper.

## Basic Maintenance Tools

The tools discussed in this white paper are all free from the Microsoft Web site or Codeplex, Microsoft’s open-source community Web site.

PTC recommends the installation and use of the following Microsoft or community products:

- [Microsoft SQL Server 2005 Management Studio](#) (SSMS)<sup>2</sup>, which includes:
  - SQL Server Database Tuning Advisor
  - SQL Server Profiler
- [Microsoft SQL Server 2005 Best Practices Analyzer](#)

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<sup>2</sup> SSMS installs with SQL Server as an option. SSMS may also be installed without SQL Server.

- [Codeplex's SQL Server 2005 Performance Dashboard](#) (source code donated by Microsoft)
- [Codeplex's Performance Analysis of Logs \(PAL\) tool](#), which requires the installation of additional components (covered later in this paper)

Using these tools can greatly reduce the time needed to do maintenance, especially when compared to manually performing all the best practices tasks required to keep your system in top shape.

## SQL Server 2005 Management Studio

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SSMS is an easy-to-use graphical management tool for SQL Server 2005. This tool includes script editors, graphical tools, and a collection of utilities that can assist with troubleshooting and tuning. To tune your Windchill database, you can use two of these utilities:

- Database Tuning Advisor (DTA)
- SQL Server Profiler

SSMS also provides a wizard to automate maintenance tasks.

### Database Tuning Advisor

A database changes its nature over time and needs to be tuned for optimum performance. The DTA is a wizard utility built into SSMS that uses a query optimizer to:

- Recommend the best mix of indexes for databases
- Recommend aligned or non-aligned partitions for databases
- Recommend indexed views for databases
- Analyze the effects of the proposed changes, including index usage, query distribution among tables, and query performance of a workload
- Provide reports that summarize the potential effects of implementing the recommendations for a given workload

The DTA also lets you customize its recommendations by specifying advanced options such as disk space constraints. (See [Database Engine Tuning Advisor Reference](#) and [Database Engine Tuning Advisor Features](#) for more information about using the DTA.)

Usage patterns and loads for Windchill can vary greatly between customers. This variability prevents extensive pre-tuning of the database before installation. In addition, after you first install Windchill, an atypical workload occurs from loading documents and establishing projects. However, after you have the database loaded and an ongoing pattern of additions, updates, and deletes is established, you have the opportunity to run the DTA and do some tuning.

The key to doing effective tuning is to use SQL Server Profiler with the Tuning template to capture a workload for the DTA to analyze. This method of creating workloads is the simplest and works well for capturing ad hoc workloads.

### SQL Server Profiler

SQL Server Profiler is a standalone tool that captures SQL Server events from a server and saves them to a trace file. You can then replay the events and analyze them to see what is happening

on your server. As we noted above, the DTA can also use a captured workload to evaluate the impact of additional indexes on queries.

Let's look at how to use Profiler and the DTA to perform the following tasks:

- Create a workload
- Run a tuning session
- Determine what recommendations to implement
- Determine when to implement those recommendations

Remember that there can be a great variety of workloads among Windchill customers and installations, so to get the best performance for your specific workload, you need to tune each instance of Windchill separately. Fortunately, this is an easy process using tools such as the DTA.

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A best practice is to run SSMS, the DTA, and Profiler from your desktop machine and not on the machine hosting SQL Server.

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## Creating a Workload Using SQL Server Profiler

You should capture your workload when the system is busy. The captures should include three types of workloads:

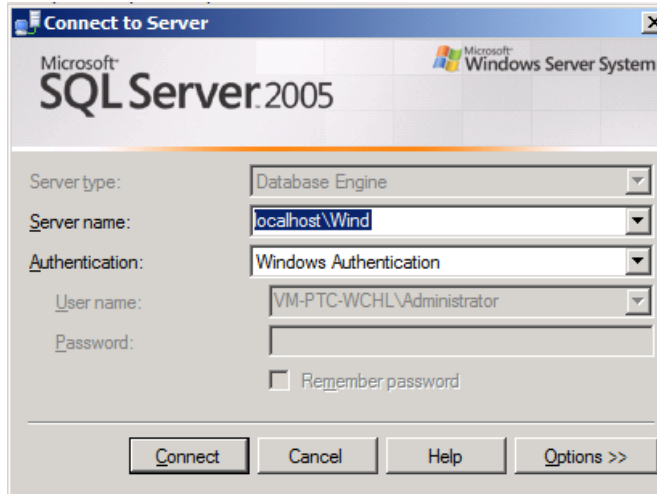
- "Opening the week," which is the first two business hours on a Monday. This period will give you a profile dominated by people checking out documents.
- "Closing the week," which is the last two business hours of a Friday. This period will be dominated by people checking in or rolling back documents.
- "Typically busy," which often means between 10-11am or 2-4pm on Tuesdays, Wednesdays, or Thursdays. This period will be a mixture of check-in and check-out activity, as well as other typical Windchill operations such as searching, downloading, running reports, and checking assigned tasks.

The steps for creating a workload are as follows:

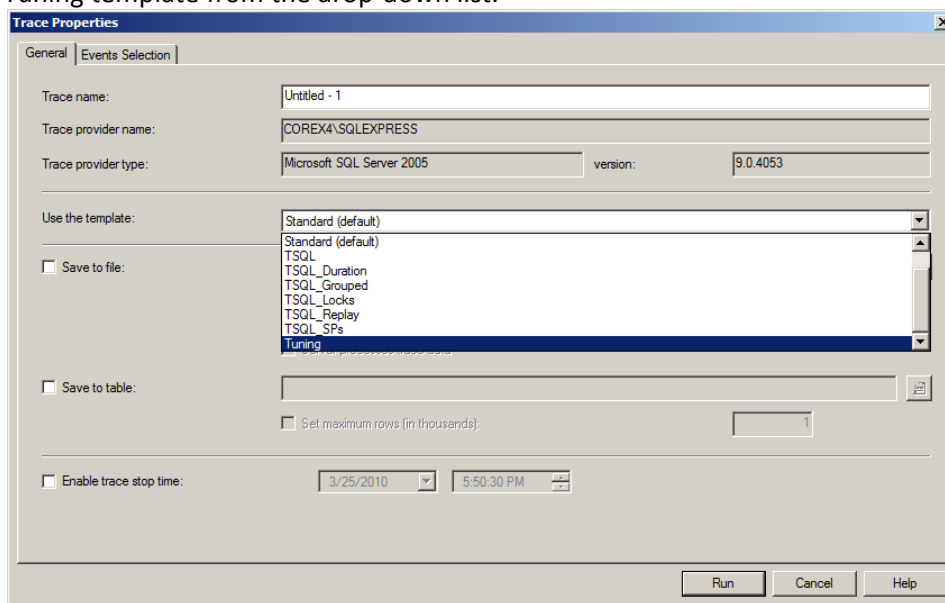
1. Open SSMS.
2. On the menu, click Tools and then SQL Server Profiler to open the Profiler application.



3. The resulting Connect to Server dialog box lets you log in to the Windchill instance.



4. From the Trace Properties dialog box that appears, click the General tab and select the Tuning template from the drop-down list.



- a. You have two choices for where to save the data: *Save to file* or *Save to table*.

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PTC recommends saving to a file, which has the advantage of being easy to forward to PTC for further analysis. Saving to a file also removes load from SQL Server so that your production environment is minimally impacted.

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- b. To set the end time for the trace, select the *Enable trace stop time* check box and enter the time in the controls to the right of the check box.
5. Next, you need to set the Maximum File Size of the trace. PTC recommends 1GB as a starting point; you can then increase or decrease the file size with experience.
  - a. Do not do detail tracing. A single Windchill operation can result in a 2GB trace log. PTC recommends always limiting the maximum file size to significantly less than the available space on the drive.

- b. If the Tuning template produces too much data, you may want to create your own template starting with captures of the following events only:
      - RPC:Completed
      - SQL:BatchCompleted
      - SP:StmtCompleted
    - b. For information about building a custom template, see [How to: Create Workloads](#).
  6. You now need to determine when you expect the heaviest load in the period. Do you expect it at the beginning or the end of the trace period? The trace file may run out of space, so you need to determine what information you want retained.
    - a. If you expect the heaviest load toward the end, select Enable File Rollover.
    - b. If you expect the heaviest load at the beginning, deselect the default Enable File Rollover.
    - c. If unsure, leave this option unchecked and revisit later.
  7. Leave the Event Selection tab with the default values.
  8. Click Run. That is it!

If you follow the above steps, it should take you only a couple of minutes to define a trace that will give you the workload you want to analyze. Profiler will automatically record the activity until you stop the recording or reach the specified end time. There is no need to monitor the capture.

Two additional notes to keep in mind about Profiler:

- The longer the trace captures data, the bigger the file produced (up to the limit specified). Use your first run to estimate MB/minute of data capture for future runs of Profiler tracing.
- The more queries captured by your Profiler trace, the better results you will get using the trace data with the DTA utility.

For more information about using Profiler, see

- [How to: Create a Trace \(SQL Server Profiler\)](#)
- [How to: Correlate a Trace with Windows Performance Log Data \(SQL Server Profiler\)](#)
- [Mastering SQL Server Profiler – Video Training Course](#)
- [Microsoft's Patterns & Practices: How to: Use SQL Profiler](#)
- [MSDN Webcast: Application Performance Tuning Using SQL Server Profiler 2005 \(Level 200\)](#)
- [Running Profiler on a Busy SQL Server](#)
- [SQL Server Profiler Tutorial Video: Profiler 101](#)

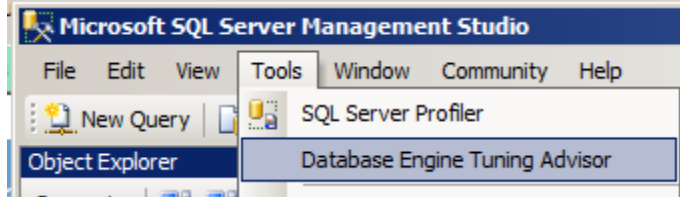
## Running a DTA Tuning Session

With a workload captured to a file in Profiler, your next step is to use that file as input to the DTA to determine any tuning recommendations. Preparing the DTA session also takes less than 2 minutes, but the DTA will require some time to perform its analysis and return recommendations.

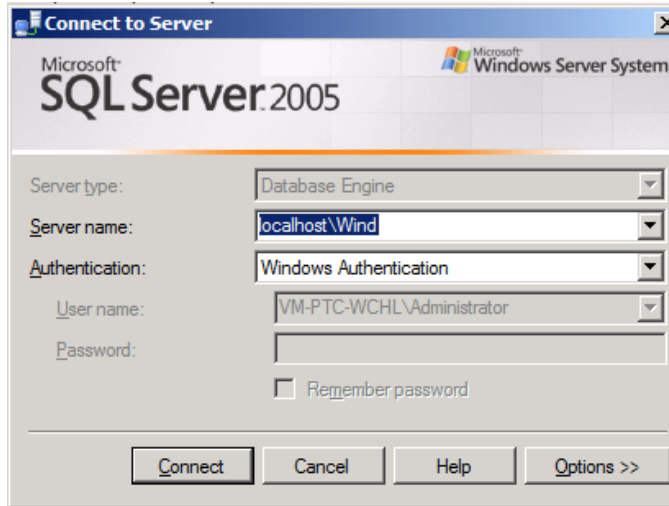
Follow these steps for defining a DTA tuning session:

1. Open SSMS.

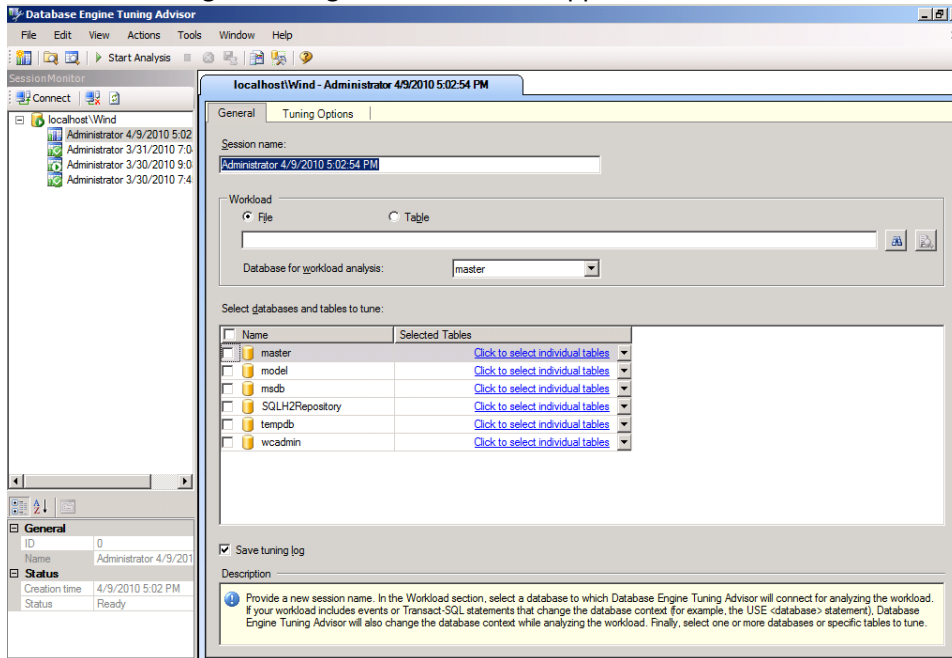
2. On the menu, click Tools and then Database Engine Tuning Advisor to open the application.



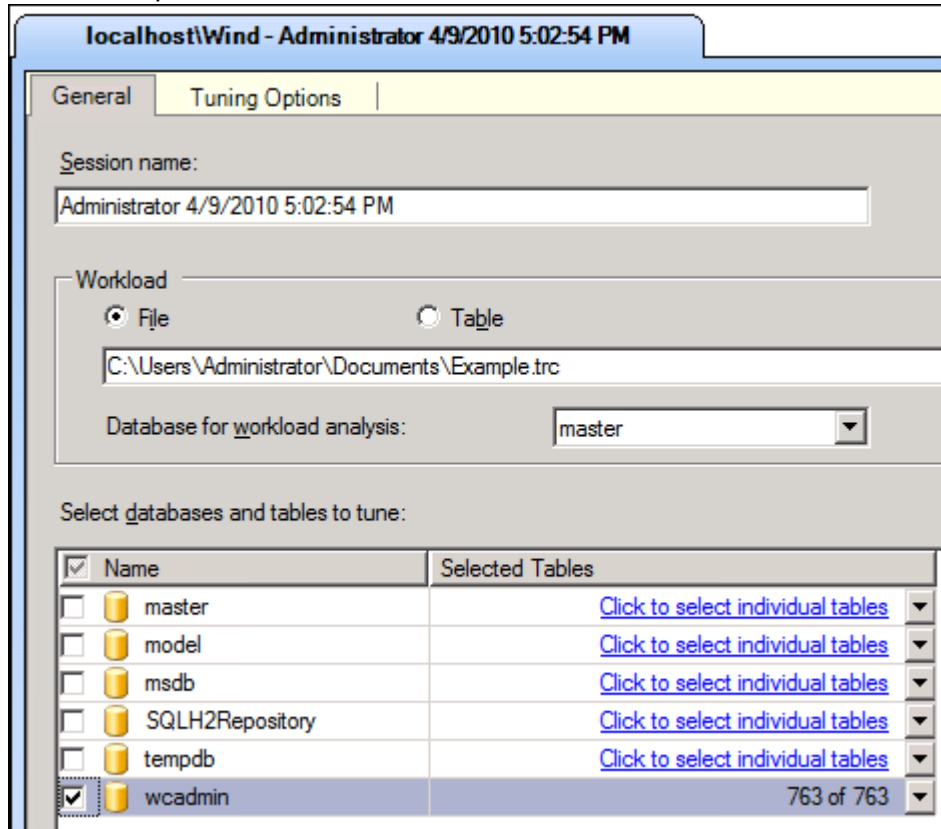
3. The Connect to Server dialog box will appear. Enter the appropriate login information and connect.



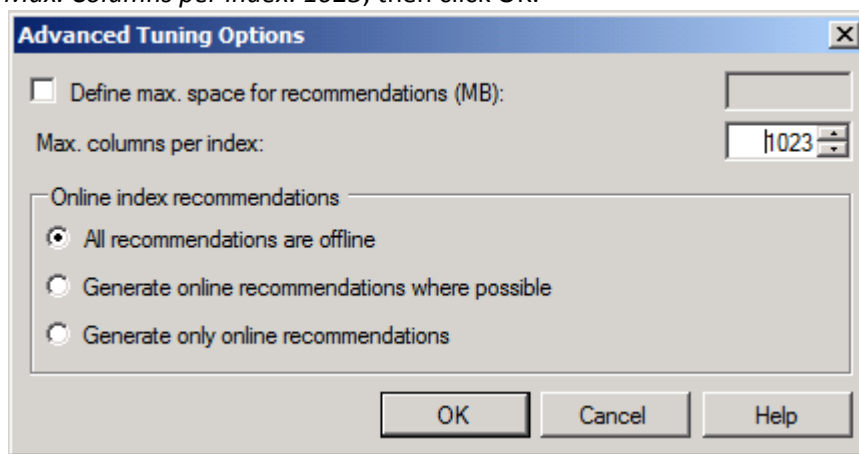
4. The Database Engine Tuning Advisor will then appear.



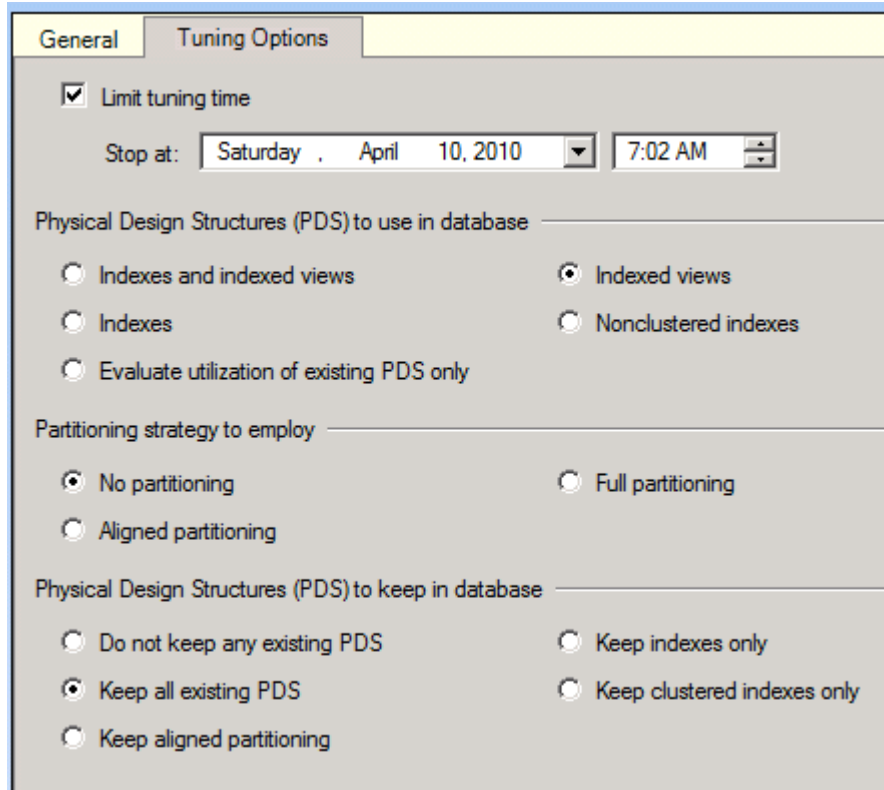
5. Select the database you want to tune (wcAdmin in this example) and select the Workload file you created. Note that selecting the Windchill (wcAdmin) database will automatically select all 763 tables in Windchill.



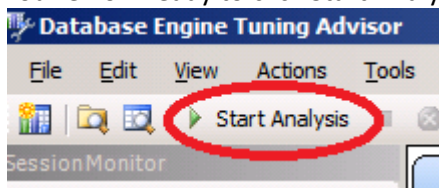
- a. Next, click the Tuning Options tab. For your first run, select the Indexes, *No partitioning*, and *Keep all existing PDS* radio buttons.
6. Click Advance Options. Verify the default settings of *All recommendations are offline* and *Max. Columns per index: 1023*, then click OK.



7. Now estimate how long this machine is going to be unused. Typically, running the DTA is an end-of-day activity, so set the time to an hour before you come into work.



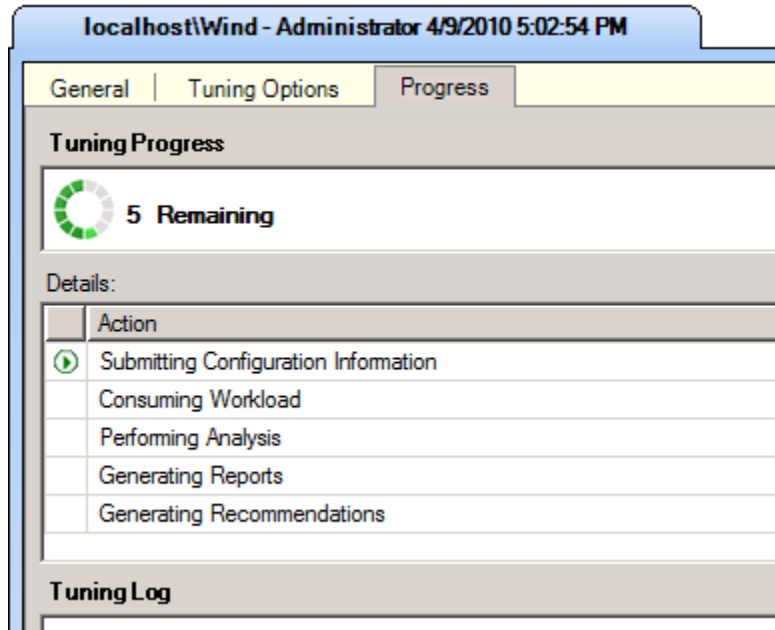
8. You're now ready to click Start Analysis.



9. The screen will immediately start filling up with the captured activity.

EventClass	TextData	Duration	SPID	DatabaseID	DatabaseName	ObjectName	LoginName
RPC:Completed	exec sp_execute 631,10191,N'wt.proj...	0	54	5	wcadmin		wcadmin
SP:StmtCompleted	SELECT 'wt.fc.dynamiceum.FilteredD...	0	54	5	wcadmin	20816 - PQ	wcadmin
RPC:Completed	exec sp_execute 631,7630,N'wt.proje...	0	54	5	wcadmin		wcadmin
SP:StmtCompleted	SELECT 'wt.fc.dynamiceum.FilteredD...	0	54	5	wcadmin	20816 - PQ	wcadmin
RPC:Completed	exec sp_execute 631,4,N'wt.project...	0	54	5	wcadmin		wcadmin
SP:StmtCompleted	SELECT 'wt.team.RolePrincipaMap',A...	0	54	5	wcadmin	20816 - PQ	wcadmin
RPC:Completed	exec sp_execute 632,N'roleGroups',1...	0	54	5	wcadmin		wcadmin
SP:StmtCompleted	SELECT 'wt.team.RolePrincipaMap',A...	0	54	5	wcadmin	20816 - PQ	wcadmin
RPC:Completed	exec sp_execute 632,N'orgs',10190	0	54	5	wcadmin		wcadmin
SP:StmtCompleted	(SELECT 0 indexAlias ,CONVERT(image...	0	54	5	wcadmin	20816 - PQ	wcadmin
RPC:Completed	declare @p1 int set @p1=633 exec ...	7	54	5	wcadmin		wcadmin
SP:StmtCompleted	SELECT 'wt.access.PolicyAc1',A0.blo...	0	54	5	wcadmin	20816 - PQ	wcadmin
RPC:Completed	exec sp_execute 607,7,N'wt.rule.Typ...	0	54	5	wcadmin		wcadmin
SP:StmtCompleted	SELECT 'wt.rule.TypeBasedRule',A0.c...	2	54	5	wcadmin	20816 - PQ	wcadmin
RPC:Completed	declare @p1 int set @p1=634 exec ...	6	54	5	wcadmin		wcadmin
SP:StmtCompleted	SELECT 0 indexAlias ,A0.blobSentryS...	0	54	5	wcadmin	20816 - PQ	wcadmin
RPC:Completed	declare @p1 int set @p1=635 exec ...	2	54	5	wcadmin		wcadmin
SP:StmtCompleted	SELECT 'wt.preference.PreferenceIns...	0	54	5	wcadmin	20816 - PQ	wcadmin
RPC:Completed	declare @p1 int set @p1=636 exec ...	0	54	5	wcadmin		wcadmin
SQL:BatchCompleted	IF @@TRANCOUNT > 0 COMMIT TRAN	0	54	5	wcadmin		wcadmin
RPC:Completed	exec sp_unprepare 636	0	54	5	wcadmin		wcadmin

10. You will notice a new Progress tab in the DTA. The process can take several hours to complete if the workload contains a large amount of transactions.

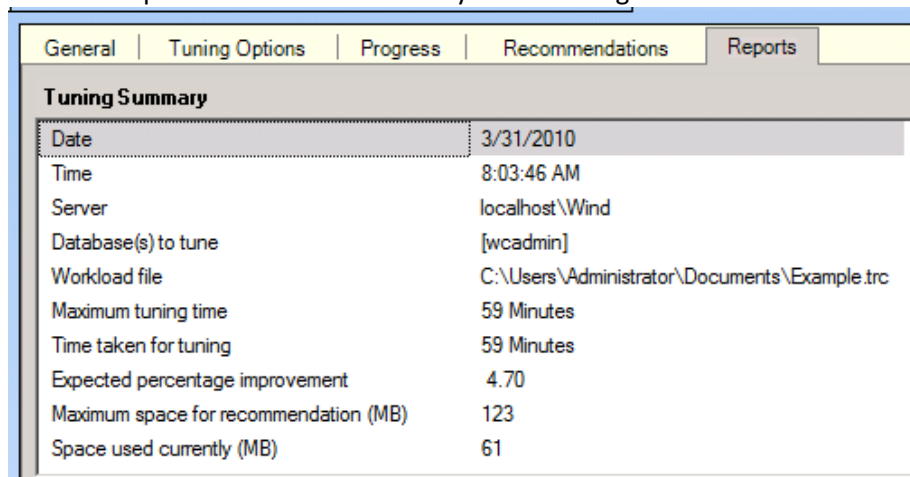


11. When the tuning calculations are complete, you will see two additional new tabs: Recommendations and Reports. Make sure you have a latte or equivalent in hand—you will be looking at the results for a while.

## Reviewing a DTA Tuning Session

Here are some recommendations for reviewing a DTA tuning session.

1. Click the Reports tab to see a summary of the tuning session.



- At the bottom of the tab, click the Select Report combo box to see a list of available reports.

**Tuning Reports**

Select report: Statement cost report

Statement Id	Statement String
15	SELECT A0.displayStatus,A0.idA3A3...
848	SELECT A0.displayStatus,A0.idA3A3...
812	SELECT A0.displayStatus,A0.idA3A3...
832	SELECT A0.displayStatus,A0.idA3A3...
367	SELECT A0.displayStatus,A0.uiComp...
807	SELECT 'wt.ac
358	SELECT 'wt.ac
114	SELECT 'wt.ac
372	SELECT 'wt.ac
827	SELECT 'wt.ac

- Traverse each of the reports to see what the DTA found. For example, the Statement cost report shows how much performance improvement you may see for various statements (in this example, a few statements are predicted to improve by 94%!).

**Tuning Reports**

Select report: Statement cost report

Statement Id	Statement String	Percent Improvement	Statement Type
15	SELECT A0.displayStatus,A0.idA3A3...	94.12	Select
848	SELECT A0.displayStatus,A0.idA3A3...	94.12	Select
812	SELECT A0.displayStatus,A0.idA3A3...	94.12	Select
832	SELECT A0.displayStatus,A0.idA3A3...	94.12	Select
367	SELECT A0.displayStatus,A0.uiComp...	91.03	Select

- Now click the Recommendations tab to see the DTA's index recommendations.

**Index Recommendations**

Database Name	O...	T...	P...	Definition
wcadmin				{(inheritedDomain) asc}
wcadmin				{(distributable) asc}
wcadmin				{(idA3A5) asc, (idA2A2) asc, (idA3B5) asc} include {(classnamekeyroleAObjectRef}, {(classnamekeyroleBObjectRef}, {cr...
wcadmin				{(idA3A5) asc, (name) asc, (markForDeleteA2) asc, (idA2A2) asc, (idA3B5) asc} include {(classnamekeyroleAObjectRef}
wcadmin				{(finalPhase) asc}
wcadmin				{(updateCountA2) asc}
wcadmin				{(updateCountA2) asc}
wcadmin				{(clientOverridable) asc}
wcadmin				{(markForDeleteA2) asc} include {(clientData}, {(clientDelegate}, {(clientOverridable}, {(defaultValue}, {(displayName}, {(fullD...
wcadmin				{(enabledFlag) asc, (markForDeleteA2) asc, (idA3containerReference) asc, (classnameA2A2) asc} include {(classname}
wcadmin				{(ruleType) asc, (enabledFlag) asc, (idA3containerReference) asc, (objType) asc, (idA2A2) asc, (markForDeleteA2) asc}
wcadmin				{(updateCountA2) asc}
wcadmin				{(idA3A3) asc} include {(displayStatus}, {(uiComponent)}
wcadmin				{(uiComponent) asc, (idA3A3) asc} include {(displayStatus)}
wcadmin				{(disabled) asc}
wcadmin				{(idA3B3) asc, (disabled) asc, (idA2A2) asc} include {(classnamekeyB3}, {(negative}, {(owner)}, {(permissionMask)}, {(classna...
wcadmin				{(latestIterationInfo) asc, (idA2A2) asc, (branchIdIterationInfo) asc}

- Scroll to the right until you see the Definition column.

- b. You can then select the index or indexes you want to implement. (The next section looks at how to determine which index recommendations to accept.)

## Index Selection Criteria

If you are familiar with the database, you can use that knowledge to determine the significance of various indexes. Alternatively, you could simply select all of the DTA's index recommendations—but be aware that indexes take resources to build and maintain.

If you have no detailed knowledge of the database, its tables, and their relationships, use the following heuristic to help determine which indexes to implement:

- Find the indexes that have the *smallest number of columns* (on the first pass, it will be one column only). In the above example, we have eight (8) indexes that have only one column out of the 17 suggestions, with a net improvement of 4.7%.
- Select those indexes and then click Actions, Apply Recommendations.
- Rerun the workload to see how much the added indexes improved performance. Do not expect the same index recommendations from two different trace logs. The estimations derive from the index statistics used for each query and the number of times a query occurs.

Adding an index may decrease the contribution of an index recommendation from another workload (or the same workload). Existing indexes and index recommendations are often dependent, frequently with complex interactions.

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A good rule of thumb is that if the DTA yields a 5% improvement, then add the indexes with the *lowest number of columns* and repeat the workload measurements until the improvement drops below 5%.

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**Note:** The DTA will always produce recommendations for *adding* indexes and never for deleting indexes. See [Uncover Hidden Data to Optimize Application Performance](#) for information about detecting unused or costly indexes, which you may choose to delete. Remember that an unused index consumes resources and results in poorer performance.

This tuning process may span several days, but the time involved should be less than 10 minutes a day. Run the DTA before you leave the office, and review the results and select the new indexes when you come in the next day. The payback to your organization is that users will have faster access to the data they need to do their jobs.

### Caution:

- You should not run the DTA when there is any load on the system because the process may place considerable load on SQL Server. Execute the DTA during off hours or maintenance periods.
- If the size of any of the recommended indexes is large, make sure that you have adequate available disk space to add them. There is nothing like adding an index and having a drive run out of space during the work day!

## When to Run Additional Tunings Sessions

If there is a change in your business—for example, ramping up of a new major contract—there may be a significant change in the load on the database. Often this is a good time to perform a

tuning. In the course of normal operations, PTC recommends executing the DTA as shown in **Error! Reference source not found..**

**Table 1 - Recommended Frequency of DTA Execution**

Time Since Installation	Frequency	Action
For first 6 weeks	Weekly	Run DTA with default settings
First year	Monthly	Run DTA with indexes and index views; include filtered indexes
After 1 quarter	Quarterly	Run DTA with full partitioning
After 1 quarter	Quarterly	Run DTA with indexes and index views; include filtered indexes

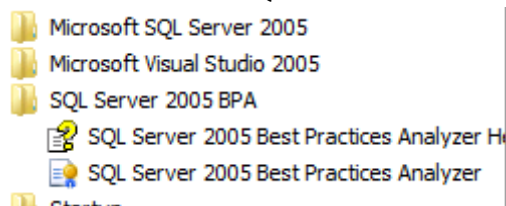
**Note:** There is rarely a need for full partitioning. For information about rebuilding indexes, see “Best Practices for PTC Windchill on Microsoft SQL Server.”

## SQL Server 2005 Best Practices Analyzer (BPA)

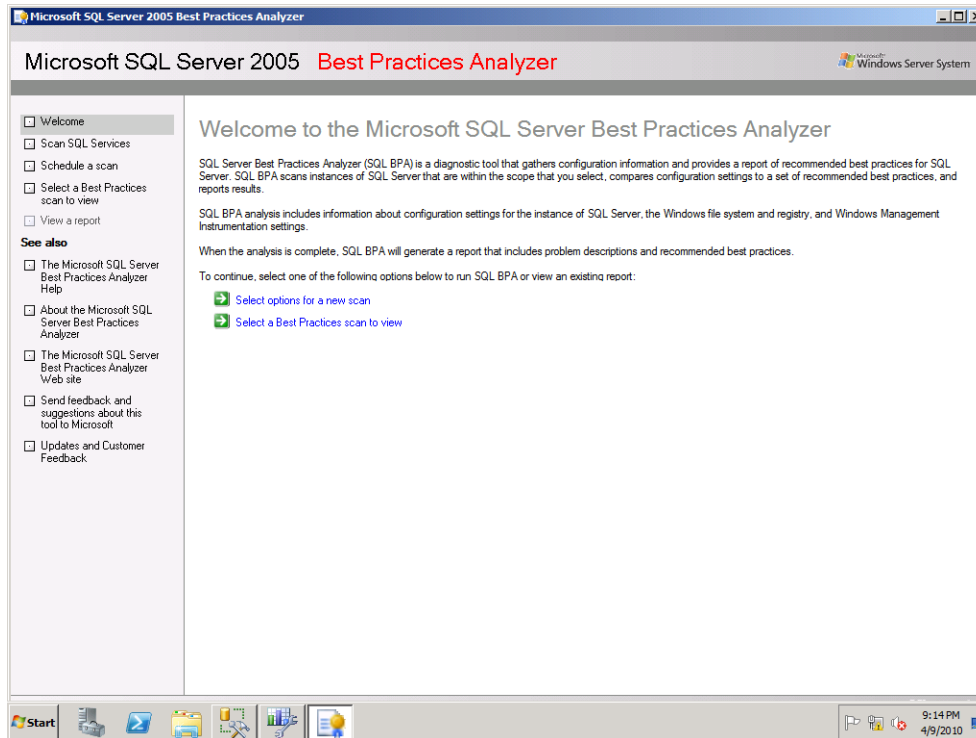
BPA does a whole system analysis of your SQL Server installation—including Microsoft Windows and SQL Server configuration and security settings—according to industry standards and best practices. BPA is very simple to use. It should be executed after the database is first created and then on a quarterly basis. Make sure you run BPA from your desktop machine and not on the SQL Server machine. You can use your desktop installation to do analysis of multiple SQL Servers.

Here’s how to run BPA:

1. After [downloading](#) and installing BPA, from the All Programs menu, select SQL Server 2005 BPA and then SQL Server 2005 Best Practices Analyzer to open the application.



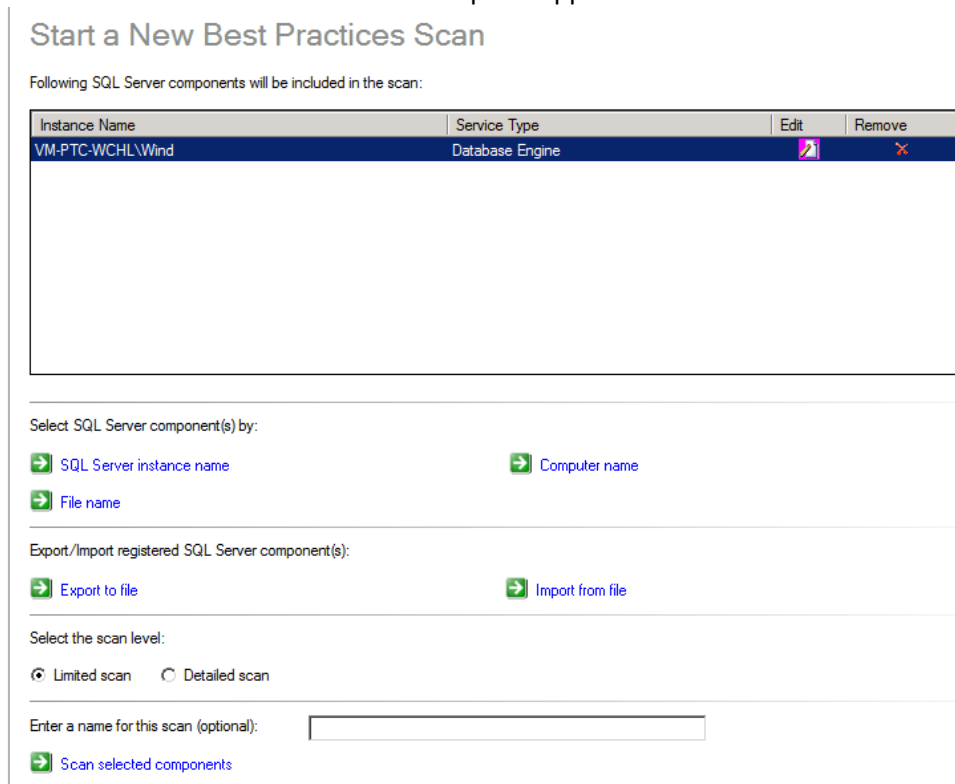
2. The application Welcome screen will appear.



3. To begin, click *Select options for a new scan*.



4. The Start a New Best Practices Scan step will appear.



5. On your first run, select the *Detail scan* radio button, enter a name for the scan such as Initial Install, and then click *Scan selected components*.

Select the scan level:

Limited scan    Detailed scan

Enter a name for this scan (optional):

[→ Scan selected components](#)

6. A progress step will appear.







### Scanning In Progress...

Please wait while the Microsoft SQL Server Best Practices Analyzer creates a Best Practices report by gathering data from the specified servers and analyzing it.

 22%

[→ Stop Scanning](#)

Server scanning details:

Total scan items: 1 in progress, 2 completed	
 [M-PTC-WCHL] Preparing to analyze host	 Completed
 [M-PTC-WCHL] Analyzing host	 Completed
 [M-PTC-WCHL\Wind] Analyzing SQL Server	 22%

7. When the scan completes, a link called *View a report of this Best Practices scan* will appear. Click this link.

### Scanning Completed

Scanning has completed successfully.

[→ View a report of this Best Practices scan](#)

8. BPA will build the report and then present it.

## View Best Practices Report

Example

Select Report Type:  List Reports  Tree Reports  Other Reports

The screenshot shows the 'All Issues' section of a Windchill report. It features a header with 'All Issues (12 items)' and navigation options: 'Print report', 'Export report', 'Find', and 'Arrange by: Class'. A list of issues follows, with one issue highlighted in yellow:

- SQL Server Service [VM-PTC-WCHL\SQLBrowser] In LocalSystem On Host [VM-PTC-WCHL].
- Unexpected System Failures On Host [VM-PTC-WCHL]
- Resolve Serious Errors In Event Log For Server [VM-PTC-WCHL\Wind] On Host [VM-PTC-W... Machine [VM-PTC-WCHL] hosting SQL Server [VM-PTC-WCHL\Wind] has experienced I/O timeouts in the storage system.**
  - Tell me more about this issue and how to resolve it.
  - Do not show me this item again for this instance only.
  - Do not show me this item again for all instances.
- Authentication Mode Violation On Server [VM-PTC-WCHL\Wind]
- BUILTIN\Administrators In SysAdmin Role On Server [VM-PTC-WCHL\Wind]
- SQL Login Password Policy Violation By Login [sa] On Server [VM-PTC-WCHL\Wind]
- SQL Login Password Policy Violation By Login [wcadmin] On Server [VM-PTC-WCHL\Wind]
- SQL Server Service [VM-PTC-WCHL\MSSQL\$Wind] In LocalSystem On Host [VM-PTC-WCH...]
- SQL Server Service [VM-PTC-WCHL\SQLAgent\$Wind] In LocalSystem On Host [VM-PTC-W...]
- SQL Server Service [VM-PTC-WCHL\msftesql\$Wind] In LocalSystem On Host [VM-PTC-WCH...]

## Expected Windchill Exceptions

The BPA report may show the exception shown in **Error! Reference source not found.**; do not correct it.

Table 2 - Expected BPA Violations

Authentication Mode Violation	Recommended Action
SQL Login Password Policy Violation by Login[wcAdmin]	Do not take any action—by design

Either correct all other violations or document the reason for the violation. PTC recommends running BPA on the frequency shown in **Error! Reference source not found.**

Table 3 - Recommended Frequency for Running BPA

Time Since Installation	Frequency	Action
First day	Once	Ensure that best practices were followed for the installation
After 6 weeks	Quarterly	Ensure that unauthorized changes have not happened

## Further Securing Your Windchill Database

The National Institute of Standards and Technology (NIST) created the [Security Content Automation Protocol \(SCAP\)](#) program with extensive consolidation of best OS and SQL Server practices. This program lists various vendor products that have passed certification for checking system security. PTC suggests using a scanner from [this list](#) in parallel to BPA.

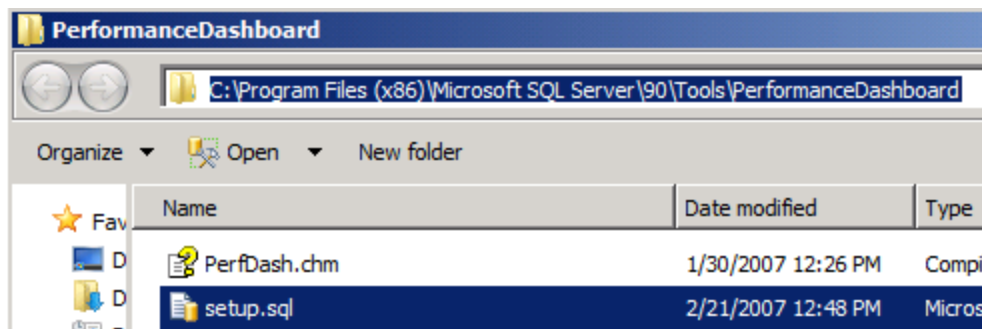
## SQL Server 2005 Performance Dashboard

A joint effort between the support and development teams at Microsoft resulted in the Performance Dashboard. The goal was to reduce the amount of time spent discovering the source of a performance problem, allowing efforts to be focused on resolving the problem. The dashboard reports rely exclusively on SQL Server 2005 dynamic management views (DMVs), using data that is already captured and always available.

The data represents information gathered since the database started. There is **zero performance impact** of using the dashboard except when you actually open/refresh a report. The recommended schedule for viewing the reports is daily while the system is first stabilizing after installation or any major change/update, and then weekly thereafter.

After [downloading](#) and installing the dashboard, you need to execute a single script to enable the Performance Dashboard. This setup.sql file will typically be located at C:\Program Files (x86)\Microsoft SQL Server\90\Tools\PerformanceDashboard after installation of the download, as **Error! Reference source not found.** shows. The Performance Dashboard does not consume additional resources.

Figure 1 - The setup.sql script for Performance Dashboard

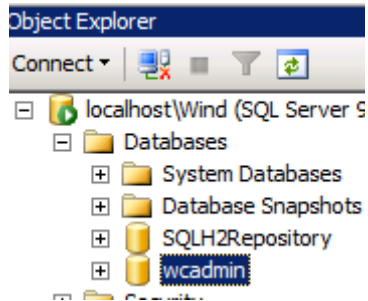


**Note:** You should install the Performance Dashboard on your desktop machine and run it from there, not on the SQL Server machine.

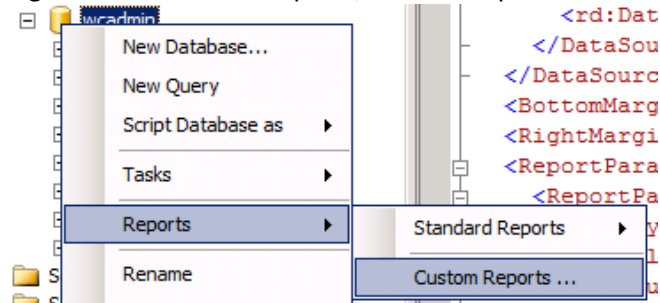
## Performance Dashboard Reports

Here is how to view the Performance Dashboard reports:

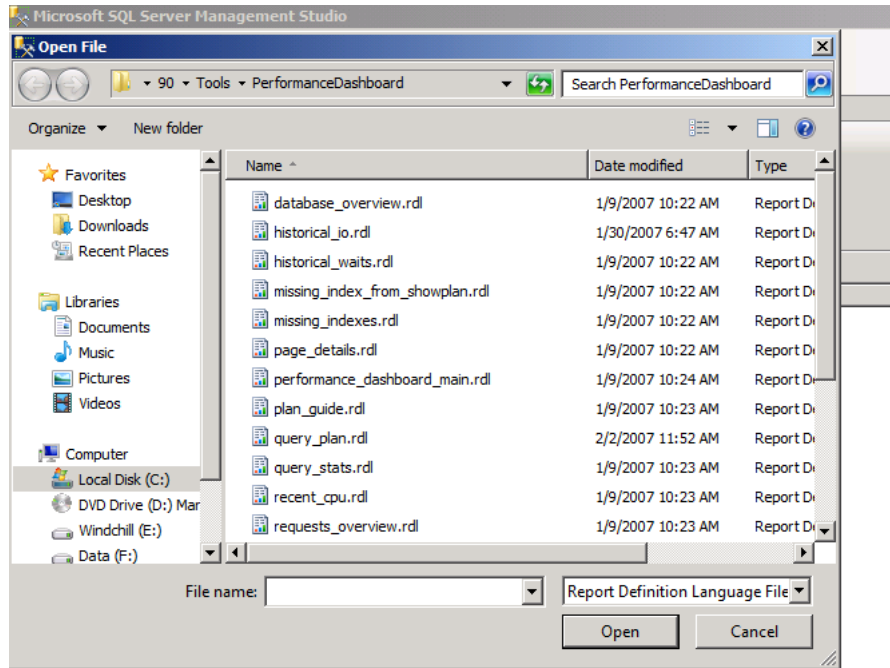
1. Open SSMS.
2. Select the wcAdmin database.



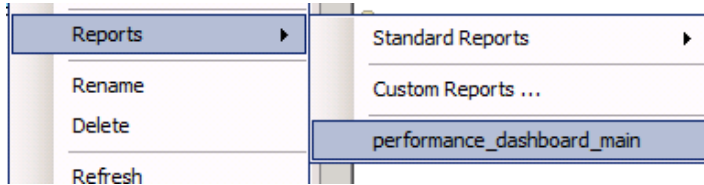
3. Right-click and select Reports, Custom Reports...



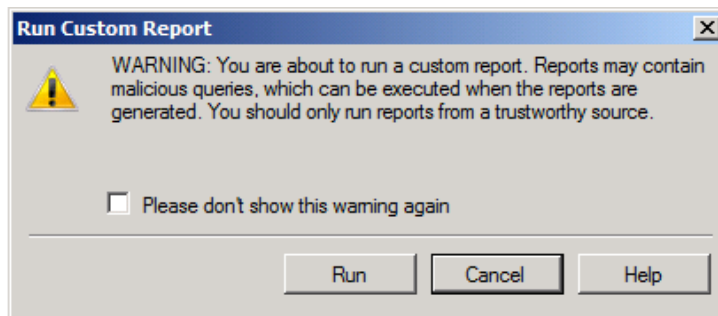
4. An Open File dialog box will appear. Navigate to the installation folder—C:\Program Files (x86)\Microsoft SQL Server\90\Tools\PerformanceDashboard—and select performance\_dashboard\_main.rdl.



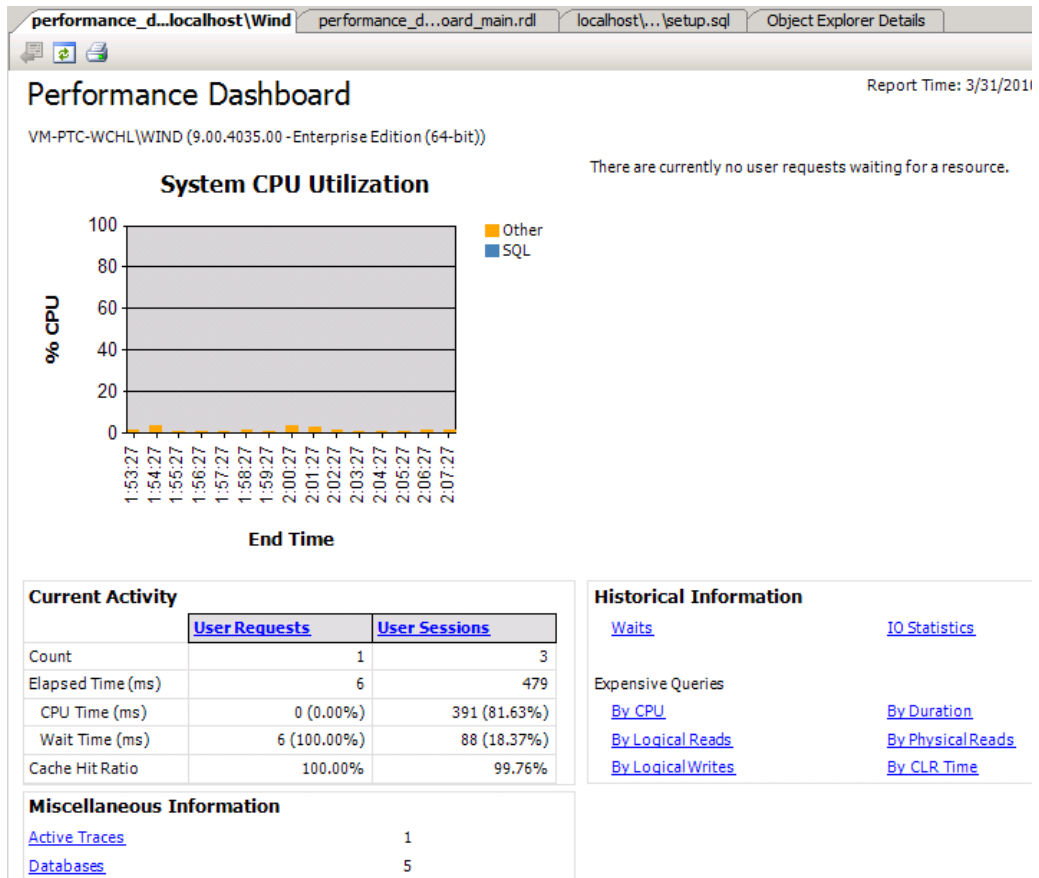
5. The Reports menu options will change, with a performance\_dashboard\_main item added.



6. When the warning dialog box appears, select the *Please do not show this warning again* box and click Run.



7. The dashboard will now appear.





9. The report that you should pay special attention to is the Missing Indexes report, located at the bottom of the dashboard page under Miscellaneous Information.

<b>Miscellaneous Information</b>	
<a href="#">Active Traces</a>	1
<a href="#">Databases</a>	6
<a href="#">Missing Indexes</a>	1

10. When you click the Missing Indexes link, you see the recommendation and the definition of the proposed new index.

Avg Total User Cost	Avg User Impact	Proposed Index
0	0.07	55.04 CREATE INDEX missing_index_9 ON [msdb].[dbo].[DTA_reports_table] ([DatabaseID]) INCLUDE ([TableID], [SchemaName], [TableName])

- a. These index recommendations usually represent those that can produce the greatest immediate impact and are preferred over the DTA recommendations for adding new indexes.

If you hear rumors of slow performance, the Performance Dashboard should be your first plan of action; you should view all the reports and drill down into the issues. For additional reports and information about them, see [SQL Server Management Studio Standard Reports – The Full List](#). In terms of proactive maintenance, PTC recommends following the schedule that **Error! Reference source not found.** shows.

**Table 4 - Recommended Proactive Use of Performance Dashboard**

Time Since Installation	Frequency	Action
For first 6 weeks	Daily	Review for any performance issue exposed with building load on Windchill
After 6 weeks	Weekly	Include a few charts in any weekly reports you send out; it is both good user-relationship management and ensures that you are reviewing the reports

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Caveat: Collected information is lost whenever SQL Server restarts. If you want to retain this information, see the following Codeplex project, sponsored by the Microsoft SQL Server Customer Advisory Best Practices Team: [SQL DMVStats 1.01](#).

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For more information about Performance Dashboard, see:

- [Making the Most Out of the SQL Server 2005 Performance Dashboard](#)
- [SQL Server 2005 Performance Dashboard Reports](#)
- [SQL Server 2005 Performance Dashboard Reports—Now Available!](#)

# Performance Analysis of Logs (PAL)

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PAL steps outside of the SQL Server world and looks at the ecosystem that SQL Server is running in. PAL reads in a Performance Monitor counter log (any known format) and analyzes it using complex but known thresholds provided in the tool. The tool then generates an HTML-based report, which graphically charts important performance counters and throws alerts showing exceeded thresholds. Microsoft product teams and members of Microsoft Support defined the thresholds.

Do not install PAL on the machine running SQL Server but rather [download](#) and install it on your desktop machine because it requires installation of several additional components.

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A best practice is to keep the SQL Server machine as a dedicated machine. Only install what is required for SQL Server to run.

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When you install PAL, you also need to install:

- [Log Parser 2.2](#)
- [Microsoft Office 2003 Add-in: Office Web Components](#)

Because there is a training video available at [Performance Analysis of Logs \(PAL\) Tool](#), we will give you just a quick overview of what this tool provides. PAL produces a summary page of the analysis with the number of items found, as shown in **Error! Reference source not found.**

## Figure 2 - PAL Summary Page

- Network
  - [Network Utilization Analysis \(Alerts: 0\)](#)
  - [Network Output Queue Length Analysis \(Alerts: 0\)](#)
  - [Memory Committed Bytes \(Stats only\)](#)
- Disk
  - [Physical Disk Read Latency Analysis \(Alerts: 8\)](#)
  - [Physical Disk Write Latency Analysis \(Alerts: 6\)](#)
  - [Logical Disk Read Latency Analysis \(Alerts: 8\)](#)
  - [Logical Disk Write Latency Analysis \(Alerts: 4\)](#)
  - [Disk Free Space for a Kernel Dump \(Alerts: 0\)](#)
  - [Process IO Data Operations/sec \(Alerts: 0\)](#)
  - [Process IO Other Operations/sec \(Alerts: 0\)](#)
  - [LogicalDisk Disk Transfers/sec \(Alerts: 0\)](#)
- Memory
  - [Free System Page Table Entries \(Alerts: 0\)](#)
  - [Pool Non Paged Bytes \(Alerts: 0\)](#)
  - [Pool Paged Bytes \(Alerts: 0\)](#)
  - [Available Memory \(Alerts: 11\)](#)
  - [Memory Pages/sec \(Alerts: 0\)](#)
  - [Memory Leak Detection \(Alerts: 0\)](#)
  - [Handle Leak Detection \(Alerts: 0\)](#)
  - [Process Thread Count \(Alerts: 0\)](#)
  - [High Virtual Memory Usage \(Alerts: 0\)](#)
  - [Process Working Set \(Alerts: 0\)](#)
  - [Memory System Cache Resident Bytes \(Alerts: 0\)](#)
  - [Memory Pages Input/sec \(Alerts: 9\)](#)
  - [Memory Percent Committed Bytes In Use \(Alerts: 0\)](#)

Clicking any of the analysis links drills down into the issue, including a link to further reading on the problem found, as shown in **Error! Not a valid bookmark self-reference..**

Figure 3 - PAL Drill-down Page

## Logical Disk Read Latency Analysis

**Description:** Avg. Disk sec/Read is the average time, in seconds, of a read of data to the disk. This analysis is used to identify disk subsystems that are responding slowly.

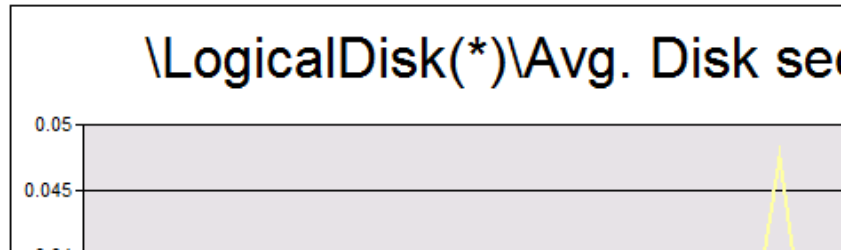
If the response times are greater than **.015 (15 milliseconds)**, then the disk subsystem is keeping up.

If the response times are greater than **.025 (25 milliseconds)**, then noticeable slow downs and performance issues are likely to occur.

**Reference:**

Ruling Out Disk-Bound Problems

<http://technet.microsoft.com/en-us/library/5bcdd349-dcc6-43eb-9dc3-54175f7061ad.aspx>



Like the Performance Dashboard reports, PAL is a proactive maintenance tool, and its usage should follow the same pattern, as shown in **Error! Reference source not found.**

Table 5 - Recommended Schedule for PAL Reviews

Time Since Installation	Frequency	Action
For first 6 weeks	Daily	Review for any performance issue exposed with building load on Windchill
After 6 weeks	Weekly	Include a few charts in any weekly reports you send out; it is both good user-relationship management and ensures that you are reviewing the reports

For more information about Windows ecosystem performance, see

- [Clint Huffman's Windows Performance Blog](#)
- [Clint Huffman's Windows Troubleshooting in the Field Blog](#)

## Summary

The tables below summarize the *minimum* recommended practices using these maintenance tools. The critical items listed in **Error! Reference source not found.** are good items to include as bullets in weekly reports. The suggested items listed in **Error! Reference source not found.** are routine maintenance items that should be included in weekly reports when *exceptions* occur.

**Table 6 - Summary of Recommended Run Schedule for Maintenance Tools**

Time from Install	Frequency	Tools
On install	Once	BPA
First 6 weeks	Daily	Dashboard Reports
	Daily	PAL
First year	Weekly	Run DTA with default settings
	Monthly	Run DTA with indexes and index views; include filtered indexes
After 1 quarter	Weekly	Dashboard Reports
	Weekly	PAL
	Quarterly	Run DTA with full partitioning
	Quarterly	Run DTA with indexes and index views; include filtered indexes
	Quarterly	BPA

You can also consider using additional tools, such as:

- [SQL Server Health and History Tool \(SQLH2\)](#)<sup>3</sup>
  - [Performance Collector](#)
  - [Reports](#)

However, these tools often have a high percentage of content overlap with reports available from the tools we covered and may not provide significant payback for the time required for you to review the information.

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<sup>3</sup> <http://sqlh2.codeplex.com/> has the latest version; the old version on Microsoft.com may hang on some machines.

**Table 7 - Minimum Frequency of Other Maintenance Tasks**

At least	Tools
Every 45 minutes	Transaction log backup
Every 3 hours	SQL Server database backup (Differential)
Daily	SQL Server database backup (Full) Check Database Integrity
Weekly	SQL Server database backup (Full) and copy to offsite location Rebuild Index (does Update Statistics also)

PTC suggests the following task sequence starting at 11pm daily:

1. Check Database Integrity
2. Rebuild Indexes (ALL)
3. Cleanup History

Follow the above tasks with this sequence one or more hours later:

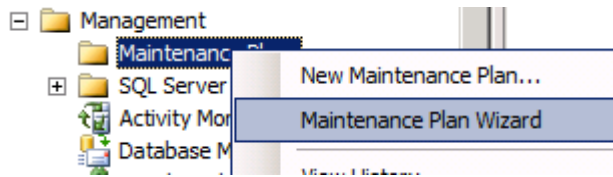
1. Check Database Integrity (DBCC CHECKDB)
2. Backup Database (Full) – with verify backup integrity
3. Maintenance Cleanup Task

PTC suggests a differential database backup and transaction log backup plan such as the one in **Error! Reference source not found.** for an 8am-5pm workday.

**Table 8 - Full, Differential, and Transaction Log Backup Plan**

Time	Activity
<b>Midnight</b>	DBCC CHECKDB Full backup Maintenance Cleanup
<b>8:45</b>	Transaction Log backup
<b>9:30</b>	Transaction Log backup
<b>10:15</b>	Differential backup
<b>11:00</b>	Transaction Log backup
<b>11:45</b>	Transaction Log backup
<b>12:30</b>	Differential backup
<b>13:15</b>	Transaction Log backup
<b>14:00</b>	Transaction Log backup
<b>14:45</b>	Differential backup
<b>15:30</b>	Transaction Log backup
<b>16:15</b>	Transaction Log backup
<b>16:15</b>	Transaction Log backup
<b>23:00</b>	DBCC CHECKDB Rebuild Indexes Cleanup History

You can automate some of the above maintenance items through SSMS. In the Object Explorer, select Server\{Windchill database name}, Management, Maintenance Plans.



For information about Maintenance Plans, see:

- [How to: Create a Maintenance Plan](#)
- [Information about the Maintenance Plan Wizard in SQL Server 2005 and about tasks that administrators can perform against SharePoint databases](#)
- [Maintenance Plan Changes in SQL Server 2005 SP2](#)
- [Maintenance Plan Wizard](#)
- [Setting up a Maintenance Plan to Backup Databases](#)
- [Top Tips for Effective Database Maintenance](#)

# Links for Further Information

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## PTC Windchill

- [Microsoft SQL Server: Improved Performance for PTC Windchill](#)
- [Windchill and Pro/INTRALINK 9.0 and 9.1 Server Hardware Sizing Guidelines – Microsoft Windows Platform](#)

SQL Server information can be found in Books Online:

- [SQL Server 2008 Books Online](#)
- [SQL Server 2005 Books Online](#)

SQL Server Books Online also includes best practice information in the following articles:

- [Best Practices for Replication Administration](#)
- [Replication Security Best Practices](#)
- [Best Practices for Recovering a Database to a Specific Recovery Point](#)

See the [SQL Server Best Practices](#) portal for technical white papers, the SQL Server Best Practices Toolbox, Top 10 Lists, and other resources.

Following is a list of technical white papers that were tested and validated by the SQL Server development team. These can help you learn more about specific SQL Server topics.

- [A Quick Look at Serial ATA \(SATA\) Disk Performance](#)
- [Benchmark for Microsoft SQL Server 2005 \(Version 1.1.1\)](#)
- [Best practices for operational excellence](#)
- [Best Practices for Running SQL Server on Computers That Have More Than 64 CPUs](#)
- [Best Practices for Semantic Data Modeling for Performance and Scalability](#)
- [Checklist: SQL Server Performance](#)
- [Checksum Problems, Choosing the Correct Recovery Model and More](#)
- [Comparing Tables Organized with Clustered Indexes versus Heaps](#)
- [Database Mirroring and Log Shipping Working Together](#)
- [Database Mirroring Best Practices and Performance Considerations](#)
- [Database Mirroring in SQL Server 2005](#)
- [Database Snapshot Performance Considerations Under I/O-Intensive Workloads](#)
- [DBCC SHOWCONTIG Improvements and Comparison between SQL Server 2000 and SQL Server 2005](#)
- [Description of using disk drive caches with SQL Server that every database administrator should know](#)
- [Disk Partition Alignment Best Practices for SQL Server](#)
- [FLASH Disk Opportunity for Server-Applications](#)

- [Generic Database Security Checklist \(Version 8, Release 1.3\)](#)
- [How to mirror the system and boot partition \(RAID1\) in Windows Server 2003](#)
- [How to use the SQLIOSim utility to simulate SQL Server activity on a disk subsystem](#)
- [How To: Use SQL Profiler](#)
- [Identifying and Resolving MDX Query Performance Bottlenecks in SQL Server 2005 Analysis Services](#)
- [Implementing Application Failover with Database Mirroring](#)
- [Improving SQL Server Performance](#)
- [Microsoft SQL Server 2005 Tuning Tips for PeopleSoft 8.x](#)
- [Microsoft SQL Server Database Engine Input/Output Requirements](#)
- [Microsoft SQL Server I/O Basics \(2005\)](#)
- [Microsoft SQL Server I/O subsystem requirements for the Temp Db database](#)
- [Monitor and troubleshoot storage performance](#)
- [Partial Database Availability](#)
- [Performance of WD 250GB SATA Drives + 3ware Controller](#)
- [Physical Database Storage Design](#)
- [Precision Considerations for Analysis Services Users](#)
- [Pre-Configuration Database Optimizations](#)
- [Pre-Deployment I/O Best Practices](#)
- [RML Utilities for SQL Server \(x64\)](#)
- [SAP with Microsoft SQL Server 2005: Best Practices for High Availability, Maximum Performance, and Scalability](#)
- [SQL Server 2005 Best Practices Analyzer \(August 2008\)](#)
- [SQL Server 2005 Deployment Guidance for Web Hosting Environments](#)
- [SQL Server 2005 Performance Dashboard Reports](#)
- [SQL Server 2005 Security Best Practices - Operational and Administrative Tasks](#)
- [SQL Server 2005 Waits and Queues](#)
- [SQL Server 7.0, SQL Server 2000, and SQL Server 2005 logging and data storage algorithms extend data reliability](#)
- [SQL Server Best Practices](#)
- [SQL Server Best Practices Article](#)
- [SQL Server Health and History Tool \(SQLH2\)](#)
- [SQL Server Replication: Providing High Availability Using Database Mirroring](#)
- [SQLIO Disk Subsystem Benchmark Tool](#)
- [Storage Top 10 Best Practices](#)
- [Support WebCast: How to Effectively Use SQL Server Profiler](#)
- [Technical Note #28: Common QA for deploying SQL Server ...](#)

- [TEMPDB Capacity Planning and Concurrency Considerations for Index Create and Rebuild](#)
- [Top Tips for Effective Database Maintenance](#)
- [Troubleshooting Performance Problems in SQL Server 2005](#)
- [Uncover Hidden Data to Optimize Application Performance](#)
- [Understanding Logging and Recovery in SQL Server](#)
- [Understanding SQL Server Backups](#)
- [Windows Server 2003 Security Guide for Member Servers \(2.1\)](#)

## **Bibliography**

- ***SQL Server MVP Deep Dives*** (Manning, 2010), Paul Nielsen, Kalen Delaney, et al.
- ***Mastering SQL Server Profiler*** (Red Gate Books, 2009), Brad McGehee
- ***Professional SQL Server 2005 Performance Tuning*** (Wiley Publishing, 2008), Steven Wort, Christian Bolton, et al.
- ***Inside Microsoft SQL Server™ 2005: The Storage Engine*** (Microsoft Press, 2006), Kalen Delaney
- ***Professional SQL Server 2005 Administration*** (Wiley, 2006), Brian Knight, Ketan Patel, et al.
- ***SQL Server 2005 Bible*** (Wiley, 2006), Paul Nielsen