

Thread Wait Chain Inspector

by

Software Verify

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Thread Wait Chain Inspector

Thread Wait Chain Inspector for Windows Operating Systems

by Software Verify Limited

Welcome to the Thread Wait Chain Inspector software tool. Thread Wait Chain Inspector is a software tool that inspects the wait chain of every thread in a particular process.

We hope you will find this document useful.

Thread Wait Chain Inspector Help

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Foreword



1 How to get Thread Wait Chain Inspector

Thread Wait Chain Inspector is free for commercial use. Thread Wait Chain Inspector can be downloaded for Software Verify's website at https://www.softwareverify.com/product/thread-wait-chain-inspector/.

This help manual is available in Compiled HTML Help (Windows Help files), PDF, and online.

Windows Helphttps://www.softwareverify.com/documentation/chm/threadWaitChainInspector.chmPDFhttps://www.softwareverify.com/documentation/pdfs/threadWaitChainInspector.pdfOnlinehttps://www.softwareverify.com/documentation/html/threadWaitChainInspector/index.html

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Visit our blog to read our articles on debugging techniques and tools. Follow us on twitter to keep track of the latest software tools and updates.

Versions

There are two versions of Thread Wait Chain Inspector:

- A version for 32 bit operating systems: threadWaitChainInspector.exe
- A version for 64 bit operating systems: threadWaitChainInspector_x64.exe.

The 32 bit version will run on 64 bit operating systems but will only show information about 32 bit processes.

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4 Thread Wait Chain Inspector Help

The 64 bit version will only run on 64 bit operating systems and will only show information about 64 bit processes.

Both versions are installed if you are using a 64 bit operating system.



2 What does Thread Wait Chain Inspector do?

Thread Wait Chain Inspector allows you to inspect information about each running thread in an application.

The display shows wait chain data in the the lower window for the process that is selected in the upper window.

For any selected thread, that thread and related threads are shown with a yellow background.

Any deadlocked threads have their wait chains shown in red.

Thread Wait Chain Inspector x64		- 🗆 ×
File Settings Help		
Lipdate Interval (miliseconds): 1000		
Process Threads: 8 PID: 12224 (0x2EC0) E:\om\c\th	read/airlaton/examples/pativeExample/DehunNonLink10_0_x64/pativeExample_x64 eve	Hevaderimal Process Names Thread Names
Thread ID Thread Name	Thread Wait Chain	Wait Time Contaxt Switcher
12580 UlThread	12224 (nativeExample x64.eve) : 12580 (UIThread) : Blocked	38,234,369 3
5836	12224 (nativeExample x64.exe) : 5836 : Running	38,233,016
4712	12224 (nativeExample x64.exe) : 4712 : Running	38,233,016
8204	12224 (nativeExample_x64.exe) : 8204 : Running	38,233,016
308	12224 (nativeExample_x64.exe) : 308 : Running	38,233,015
7672 t3pA	DEADLOCKED!	38,233,924
	12224 (nativeExample_x64.exe) : 7672 (t3pA) : Blocked	
	CriticalSection : Owned	
	12224 (nativeExample_x64.exe) : 12220 (t3pB) : Blocked	
	CriticalSection : Owned	
	12224 (nativeExample_x64.exe) : 13924 (t3pC) : Blocked	
	CriticalSection : Owned	
	12224 (nativeExample_x64.exe) : 7672 (t3pA) : Blocked	
12220 t3pB	DEADLOCKED!	38,233,924
	12224 (nativeExample_x64.exe) : 12220 (t3pB) : Blocked	
	CriticalSection : Owned	
	12224 (nativeExample_x64.exe) : 13924 (t3pC) : Blocked	
	CriticalSection : Owned	
	12224 (nativeExample_x64.exe) : 7672 (t3pA) : Blocked	
	CriticalSection : Owned	
	12224 (nativeExample_x64.exe) : 12220 (t3pB) : Blocked	

Information that is displayed about each thread:

Thread id

This is the numeric identifer assigned to the thread by the Windows operating system.

Thread Name

This is the name of the thread if the thread has been given a name using the setThreadDescription()
API. This is only available on Windows 10.

If a thread description is not available we attempt to provide a name for this thread by querying the thread's start address, and if successful we try to turn this start address into a useful symbolic name. Depending on the process and the operating system these operations may success, in which we display a name, or they may fail in which case we display nothing.

Thread Wait Chain

This is the wait chain for this thread. For each entry we show the process id and the thread id and if the object being waited upon has a name, we show that too. If process names and thread names have been

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enabled we show these as well. Some wait chains rely on waiting for other processes, which are more readily identified by process name than process id. Any deadlocks that are detected are shown in red.

Wait Time

This is how long the thread has been waiting.

Context switches

This is the number of context switches this thread has been involved in.



3 Menu

The main menu contains four menus, File, Settings, Software Updates and Help.

Thread Wait Chain Inspector x86 File Settings Software Updates Help

3.1 File

The File menu allows you to close the program.

Monitor a Process
Stop Monitoring
Load Wait Chain Information
Save Wait Chain Information
Exit

File menu > Monitor a Process... > displays the process chooser to allow you to choose which process to monitor.

File menu > Stop Monitoring > stops monitoring the process and clears the display.

File menu > Load Wait Chain Information... > loads wait chain information from a file and displays it.

File menu > Save Wait Chain Information... > save wait chain information to a file.

This can be useful for saving wait chain information for diagnosis at a later time, and for diagnosis by a colleague.

File menu > Exit > closes Thread Wait Chain Inspector

3.2 Settings

The Settings menu allows you to modify the behaviour of Thread Wait Chain Inspector.

Edit Settings
Start Logging
Stop Logging
View Logged Wait Chains

File menu > Edit Settings... > displays the settings dialog.

File menu > Start Logging > starts logging wait chains.

File menu > Stops Logging > stops logging wait chains.

File menu **> View Logged Wait Chains... >** opens the log file in the registered application for .txt files (notepad.exe on most computers).

3.3 Software Updates

The Software Updates menu controls how often software updates are downloaded.

If you've been notified of a new software release to Thread Wait Chain Inspector or just want to see if there's a new version, this feature makes it easy to update.



Software Updates menu **> Check for software updates >** checks for updates and shows the software update dialog if any exist

An internet connection is needed to be able to make contact with our servers.

Before updating the software, close the help manual, and end any active session by closing target programs.

If no updates are available, you'll just see this message:



Software Update dialog

If a software update is available for Thread Wait Chain Inspector you'll see the software update dialog.

Software update download confirmation		×	
A software update is available for Thread Wait C	hain Inspector.		
Do you wish to install Thread Wait Chain Inspect	or V1.62?		
Yes, Download and Install Don't download, ask me later Skip this version, don't tell me about it again			
Software update			
Software update options			

• **Download and install** > downloads the update, showing progress



Once the update has downloaded, Thread Wait Chain Inspector will close, run the installer, and restart.

You can stop the download at any time, if necessary.

- Don't download... > Doesn't download, but you'll be prompted for it again next time you start Thread Wait Chain Inspector
- Skip this version... > Doesn't download the update and doesn't bother you again until there's an even newer update
- Software update options... > edit the software update schedule

Problems downloading or installing?

If for whatever reason, automatic download and installation fails to complete:

• Download the latest installer manually from the software verify website.

Make some checks for possible scenarios where files may be locked by Thread Wait Chain Inspector as follows:

- Ensure Thread Wait Chain Inspector and its help manual is also closed
- Ensure any error dialogs from the previous installation are closed

You should now be ready to run the new version.

Software update schedule

Thread Wait Chain Inspector can automatically check to see if a new version of Thread Wait Chain Inspector is available for downloading.

Software Updates menu **> Configure software updates >** shows the software update schedule dialog

The update options are:

- never check for updates
- check daily (the default)
- check weekly
- check monthly

The most recent check for updates is shown at the bottom.

Software update schedule	?	×		
OutputDebugStringChecker can check for software updates on a regular basis.				
C Never check for updates				
C Check for updates every day				
Check for updates once a week				
C Check for updates once a month				
Most recent check for updates was performed on 2022-07-23				
OK	Can	icel		

Software update directory

It's important to be able to specify where software updates are downloaded to because of potential security risks that may arise from allowing the TMP directory to be executable. For example, to counteract security threats it's possible that account ownership permissions or antivirus software blocks program execution directly from the TMP directory.

The TMP directory is the default location but if for whatever reason you're not comfortable with that, you can specify your preferred download directory. This allows you to set permissions for TMP to deny execute privileges if you wish.

Software Updates menu **> Set software update directory >** shows the Software update download directory dialog

Software update download directory	?	\times
Software updates will be downloaded to the location specified below:		
C:\Users\stephen\AppData\Local\Temp	Brows	æ
	Res	et
ОК	Can	cel

An invalid directory will show the path in red and will not be accepted until a valid folder is entered.

Example reasons for invalid directories include:

- the directory doesn't exist
- the directory doesn't have write privilege (update can't be downloaded)
- the directory doesn't have execute privilege (downloaded update can't be run)

When modifying the download directory, you should ensure the directory will continue to be valid. Updates may no longer occur if the download location is later invalidated.

• **Reset >** reverts the download location to the user's TMP directory

The default location is c:\users\[username]\AppData\Local\Temp

3.4 Help

The Help menu controls displaying this help document and displaying information about Thread Wait Chain Inspector.

About Thread Wait Chain Inspector
Readme and Version History
Help Topics
Help PDF
Help on softwareverify.com
Blog
Library
Contact customer support
How do I?

Help menu **> About Thread Wait Chain Inspector... >** displays information about Thread Wait Chain Inspector.

Help menu > Readme and Version History... > displays the readme and version history.

Help menu **> Help Topics... >** displays this help file.

Help menu > Help PDF... > displays this help file in PDF format.

Help menu **> Help on softwareverify.com... >** display the Software Verify documentation web page where you can view online documentation or download compiled HTML Help and PDF help documents.

Help menu **> Blog... >** display the Software Verify blog.

Help menu **> Library... >** display the Software Verify library - our best blog articles grouped by related topics.

Help menu **> Contact customer support... >** displays the options for contacting customer support.

Contact Software Verify Customer Support	×
We provide customer support via email.	
Email allows us to exchange detailed bug descriptions, detailed instructions, screen files, crash dumps and other metadata that can't easily be communicated via teleph	shots, log Ione or chat.
Should your support request require escalation to phone, Zoom or remote compute will do that when required.	r access we
There are two methods to start a support request:	
Email:	
support@softwareverify.com	
Website customer support form:	
https://www.softwareverify.com/support.php	
	Close

Click a link to contact customer support.

Help menu **> How do I?... >** displays the options for asking us how to do a particular task.

How do I?	×
How do I fly to the moon?	
How do I make a purple cow?	
How do I do XYZ with Thread Wait Chain Inspector?	
We can't help with the first two questions, but I think we can help with the last question.	
We'll give you step by step instructions and/or a video showing you how to do XYZ.	
Just send us an email describing what you're trying to do and we'll get right back to you with solution.	a
Start a Support Request	
Email:	
support@softwareverify.com	
Website customer support form:	
https://www.softwareverify.com/support/	
Close	



4 The user interface

The Thread Wait Chain Inspector user interface displays the threads of the selected process:

III Thread Wait Ch	ain Inspector x64			– 🗆 ×
File Settings He	lp			
Update Interval (millis	econdst 1000 -	7		
Process Threads: 7	PID: 11128 (0x2B78)	— E:\om\c\threadValidatoi\examples\nativeExample\DebugNonLink10_0_x64\nativeExample_x64.exe	E Hexadecimal V Pro	cess Names 🔽 Thread Names
Thread ID	Thread Name	Thread Wait Chain	Wait Time	Context Switches
10768	UIThread	11128 (nativeExample_x64.exe) : 10768 (UIThread) : Blocked	38,231,929	4,182
11852		11128 (nativeExample_x64.exe) : 11852 : Running	38,229,866	1
8748	tpGoodA	11128 (nativeExample_x64.exe) : 8748 (tpGoodA) : Blocked	38,231,929	62
		CriticalSection : Owned		
		11128 (nativeExample_x64.exe) : 1232 (tpGoodB) : Blocked		
1232	tpGoodB	11128 (nativeExample_x64.exe) : 1232 (tpGoodB) : Blocked	38,231,929	44
12272	tpGoodC	11128 (nativeExample_x64.exe) : 12272 (tpGoodC) : Blocked	38,231,901	19
		CriticalSection : Owned		
		11128 (nativeExample_x64.exe) : 1232 (tpGoodB) : Blocked		
1604		11128 (nativeExample_x64.exe) : 1604 : Running	38,231,788	1
9016		11128 (nativeExample_x64.exe) : 9016 : Running	38,231,788	1

Usage

You can sort the thread list by clicking the column header to select the column. Clicking the already selected column header again reverses the sort direction.

🕅 Thread Wait Chain Inspector x64		×
File Settings Help		
Indate Interval (militaconde)		
Process Threads: 9 PID: 12224 (0-2000) Ethom/s/th	read/aidated ausendes/nativeEvande/Deburthed in:10-0-vE4/nativeEvande-vE4 ave	E Hausdarian E Brassa Nama E Through Nama
Thread ID Thread Name	V Thread Wait Chain	Wait Time Context Switcher
12580 UIThread	12224 (nativeExample x64.eve) : 12580 (UIThread) : Blocked	38.234.369 3
5836	12224 (nativeExample_or task) + 1956 (or middy) + 566 (or middy)	38,233,016
4712	12224 (nativeExample x64.exe) : 4712 : Running	38,233,016
8204	12224 (nativeExample_x64.exe) : 8204 : Running	38,233,016
308	12224 (nativeExample_x64.exe) : 308 : Running	38,233,015
7672 t3pA	DEADLOCKED!	38,233,924
	12224 (nativeExample_x64.exe) : 7672 (t3pA) : Blocked	
	CriticalSection : Owned	
	12224 (nativeExample_x64.exe) : 12220 (t3pB) : Blocked	
	CriticalSection : Owned	
	12224 (nativeExample_x64.exe) : 13924 (t3pC) : Blocked	
	CriticalSection : Owned	
	12224 (nativeExample_x64.exe) : 7672 (t3pA) : Blocked	
12220 t3pB	DEADLOCKED!	38,233,924
	12224 (nativeExample_x64.exe) : 12220 (t3pB) : Blocked	
	CriticalSection : Owned	
	12224 (nativeExample_x64.exe) : 13924 (t3pC) : Blocked	
	CriticalSection : Owned	
	12224 (nativeExample_x64.exe) : 7672 (t3pA) : Blocked	
	CriticalSection : Owned	
	12224 (nativeExample_x64.exe) : 12220 (t3pB) : Blocked	

The values shown for each thread are described here. A graphical representation of these values is shown behind the numeric values where possible.

Thread Controls

Refresh

You can update the display manually by clicking the Refresh button. This is useful if you have disabled automatic updates via the the Update Interval control.

Update Interval

You can change how frequently the display is updated using the Update Interval control. The default is to update every one second.

Process Names

As well as showing the process id in the wait chain the process name is displayed. This is enabled by default.

Thread Names

As well as showing the thread id in the wait chain the thread name is displayed. This is enabled by default.

Context Menu

The grid has a context menu. Each row in the grid represents a thread in the selected process.



Name Thread...

Display the Name Thread dialog so that you can name an un-named thread or rename a thread to have a more useful name.

Thread Name		×
Thread Id: 15048		
Thread Name: Data Encoder		
	ОК	Cancel

Create a Minidump...

This creates a minidump for the process that has been selected by the context menu (this may not be the process selected in the process list).

A create minidump dialog is displayed asking you where to save the minidump.

Copy Wait Chain Information as Text...

This copies the wait chain information that is displayed to the clipboard.

Example:

```
11104 (waitChainTester.exe) : 3216 : Blocked Wait Time: 48,823,605 Context Switches: 7,383
11104 (waitChainTester.exe) : 7300 (threadProcess2) : Blocked Wait Time: 48,820,804 Context
Process Wait : Owned
12436 (notepad.exe) : 0 : Pid Only
11104 (waitChainTester.exe) : 12588 : Running Wait Time: 48,822,522 Context Switches: 3
11104 (waitChainTester.exe) : 12812 : Running Wait Time: 48,822,522 Context Switches: 1
```



5 Create a minidump

The Create Minidump dialog is provided to allow you to choose where to save your minidump.

Create Minidump	?	\times
Filename:		
C:\Users\Stephen\AppData\Roaming\Software Verify\MiniDumps\tvExample_x64.exe.568.dmp	Browse.	
Open Folder Create Minidump	Cancel	

A suggested filename will be provided in the edit field. You can edit this filename or choose a new filename using the **Browse...** button to display the system file chooser.

Open Folder... displays the contents of the folder identified by the filename. You can use this to browse any existing minidumps.

Create Minidump will create the minidump for the selected process.



6 Process chooser dialog

The Attach to process dialog allows you to choose a user process, system process or service to attach to.

💽 Choo	se Process	to Monitor Th	nreads ?	\times
<u>A</u> ttach.	n processes	efresh	✓ User processes	mage Name
ID	Arch	Admin	Process	
8256	x64	1	C:\Program Files (x86)\Google\Update\1.3.36.122\Google	eCras
1608	x64		C:\Program Files (x86)\Microsoft\Edge\Application\mse	dge.e
2196	x64		C:\Program Files (x86)\Microsoft\Edge\Application\msec	dge.e
2848	x64		C:\Program Files (x86)\Microsoft\Edge\Application\msec	dge.e
6288	x64		C:\Program Files (x86)\Microsoft\Edge\Application\msec	dge.e
11968	x64		C:\Program Files (x86)\Microsoft\Edge\Application\msec	dge.e
6020	x64		C:\Program Files\Google\Chrome\Application\chrome.e	xe
10196	x64		C:\Program Files\Google\Chrome\Application\chrome.e	xe
11500	x64		C:\Program Files\Google\Chrome\Application\chrome.e	xe
12116	x64		C:\Program Files\Google\Chrome\Application\chrome.e	xe v

- System processes / Services / User processes > show either of system or services or user processes in the list, or both
- Full path > shows the full path to the process executable in the list
- **Image Name >** shows the short program name without path
- **Refresh** > update the list with currently running processes
- Attach > attach to the selected process and start collecting debug events

Clicking on the headers of the list will sort them by ID or by name using the full name or short name, depending on what's displayed.



7 Settings dialog

The settings dialog allows you to modify the behaviour of Thread Wait Chain Inspector.

Logging	Settings Dialog	×	
Collect data about wait chains and write to a logfile when Thread Wait Chain Inspector is closed.			
Logfile:	e:\abc\waitChainLog.txt	Browse	
	,		

- Collect data about wait chains... > turn collect of wait chain logging on or off
- Logfile > the file when the wait chain log will be written
- Browse... > open a Windows file dialog to choose the log file name
- View... > opens the log file in the registered application for .txt files (notepad.exe on most computers)
- **Open Folder...** > opens Windows file explorer to show the directory that contains the log file
- **Delete** > deletes the log file

When logging is enabled the log file will be written when Thread Wait Chain Inspector is closed.



8 Command Line Interface

Thread Wait Chain Inspector can be used from the command line as well as with the GUI.

8.1 Alphabetic Reference

/logWaitChains

Turn wait chain logging on or off

/logWaitChains:On|Off

Example:

/logWaitChains:On /logWaitChains:Off

/logWaitChainFileName

Specifies a file to write the wait chain log to. The wait chain log is written when Thread Wait Chain Inspector is closed.

/logWaitChainFileName filename

Example:

/logWaitChainFileName e:\tests\testWaitChain\waitChainLog.txt

/processId

Specify a process to monitor. The process must already be running.

/processId process-id

Example:

/processId 256

/process

Specify a process to monitor. The process must already be running.

/process process-name

Example:

/process test.exe
/process e:\om\c\testApps\native\test\debug\test.exe

