

# Windows Event Viewer Log (EVT) format

*Analysis of EVT file format*

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## Summary

The Windows Event Log (EVT) format is used by Microsoft Windows to store system log information. This specification is based on public available information and was complimented by reverse engineering of the file format.

This document is intended as a working document for the Windows Event Log (EVT) specification. Which should allow existing Open Source forensic tooling to be able to process this file type.

## Document information

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**Abstract:** This document contains information about the Windows Event Viewer Log (EVT) format.

**Classification:** Public

**Keywords:** Windows Event Viewer Log, EVT

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## Version

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0.0.1	J.B. Metz	October 2011 November 2011	Initial version.
0.0.2	J.B. Metz	March 2012 April 2012	Additional information.
0.0.3	J.B. Metz	May 2012	Additional information.
0.0.4	J.B. Metz	August 2012	Additional information regarding event categories.
0.0.5	J.B. Metz	September 2012	Additional information regarding behavior of offset in record.
0.0.6	J.B. Metz	October 2012	Additional information.
0.0.7	J.B. Metz	November 2012	Additional information regarding corruption scenarios.
0.0.8	J.B. Metz	April 2013	Additional information regarding corruption scenarios.

# Table of Contents

1. Overview.....	1
1.1. Test version.....	1
1.2. Event Log files.....	1
2. File header.....	2
2.1. File flags.....	2
3. Event record.....	3
3.1. Event type.....	4
3.2. Event identifier.....	4
3.3. Externally stored values.....	5
3.3.1. Event message strings.....	5
3.3.2. Event category.....	6
4. End of file record.....	7
5. Corruption scenarios.....	7
5.1. Dirty file with invalid offset values.....	7
5.1.1. Trailing non-event data.....	7
5.2. Truncated event record.....	7
5.2.1. Truncated strings data.....	8
5.3. Event record with data offset is beyond record size.....	8
Appendix A. References.....	9
Appendix B. GNU Free Documentation License.....	9

# 1. Overview

The Windows Event Log (EVT) format is used by Microsoft Windows to store system log information.

The EVT format was deprecated in Windows Vista in favor of EVTX.

An EVT file consists of:

- file header
- event records
- end of file record
- trailing empty values

Characteristics	Description
Byte order	little-endian
Date and time values	POSIX timestamp in UTC
Character string	Unicode strings are stored in UTF-16 little-endian without the byte order mark (BOM).

## 1.1. Test version

The following version of programs were used to test the information within this document:

- Windows NT 4
- Windows 2000
- Windows XP
- Windows 2003

## 1.2. Event Log files

On Windows NT 4 the event logs files can be found in:

C:\WINNT\System32\config\

As of Windows 2000 the default location changed to:

C:\Windows\System32\config\

Filename	Description
AppEvent.Evt	Application events
DFSR.Evt	Distributed File System replication events
DNSEvent.Evt	DNS Server events
EventCollector-Operational.Evt	
EventForwarding-Operational.Evt	
FwdEvents.Evt	Forwarded events (Event forwarding)
HrwEvents.Evt	Hardware events
Internet.Evt	Internet Explorer events

Filename	Description
NTDS.Evt	Directory service events
NtFrs.Evt	File Replication Service events
ODiag.Evt	Microsoft Office Diagnostics events
SecEvent.Evt	Security events
SysEvent.Evt	System events
WindowsPowerShell.evt	Windows PowerShell events

## 2. File header

The file header (\_Event LogHEADER) is 48 bytes of size and consists of:

offset	size	value	description
0	4	48	Size Including the size value
4	4	“LfLe”	Signature (ELF_LOG_SIGNATURE)
8	4	1	Major version
12	4	1	Minor version
16	4		First (oldest) record offset
20	4		End of file record offset
24	4		Last (newest) record number
28	4		First (oldest) record number
32	4		Maximum file size
36	4		File flags See section: 2.1 File flags
40	4		Retention
44	4	48	Copy of size This value is used to indicate the end of the file header

### 2.1. File flags

Value	Identifier	Description
0x0001	ELF_LOGFILE_HEADER_DIRTY	Is dirty
0x0002	ELF_LOGFILE_HEADER_WRAPPED	Has wrapped
0x0004	ELF_LOGFILE_LOGFULL_WRITTEN	The last write failed because there is insufficient space
0x0008	ELF_LOGFILE_ARCHIVE_SET	Should be archived Same purpose as equivalent in the file attributes

Value	Identifier	Description
		flags

### 3. Event record

The event record (EVENTLOGRECORD) is variable of size and consist of:

offset	size	value	description
0	4		Size Including the size value
4	4	“LfLe”	Signature (ELF_LOG_SIGNATURE)
8	4		Record number
12	4		Creation date Contains 32-bit Unix epoch of the date and time in UTC the record was generated
16	4		Last written date Contains 32-bit Unix epoch of the date and time in UTC the record was written to file
20	4		Event identifier
24	2		Event type
26	2		Number of strings
28	2		Event category
30	2		Event flags Actual usage unknown indicated as reserved
32	4		Closing record number Actual usage unknown indicated as reserved
36	4		Strings offset The offset is relative to the start of the record
40	4		User SID size 0 if no User SID is available
44	4		User SID offset The offset is relative to the start of the record Can contain 0 but the User SID size should also be 0
48	4		Data size 0 if no data is available
52	4		Data offset The offset is relative to the start of the

offset	size	value	description
			record
56	...		Source name Contains an UTF-16 little-endian string with end-of-string character
...	...		Computer name Contains an UTF-16 little-endian string with end-of-string character
...	...		User SID Contains a Windows NT security identifier For more information see [NTSID].
...	...		Strings Array of UTF-16 little-endian strings with end-of-string character
...	...		Data
...	...		Padding (empty values) 4-byte alignment
...	4		Copy of size This value is used to indicate the end of the event record

Note that if the “strings offset” points to the offset of “copy of size” (or “data offset” if “data size” is not 0) the strings are empty. Can the “strings offset” contain 0 ?

The offsets with corresponding sizes can contain values that point outside of the record and should be ignored.

### 3.1. Event type

Value	Identifier	Description
0x0001	Event Log_ERROR_TYPE	Error event
0x0002	Event Log_WARNING_TYPE	Warning event
0x0004	Event Log_INFORMATION_TYPE	Information event
0x0008	Event Log_AUDIT_SUCCESS	Success Audit event
0x0010	Event Log_AUDIT_FAILURE	Failure Audit event

### 3.2. Event identifier

The event identifier is 4 bytes of size and consist of:

offset	size	value	description
0.0	16 bits		Code

offset	size	value	description
2.0	12 bits		Facility
3.4	1 bit		Reserved
3.5	1 bit		Customer flags 0 => System code 1 => Customer code
3.6	2 bits		Severity 00 => Success 01 => Informational 10 => Warning 11 => Error

### 3.3. Externally stored values

Some of the data that Event Viewer shows is stored outside the event log files.

The first step to determine the location of these values is find the corresponding “event log type sub key” in the Windows registry under:

```
HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services\Event Log\
```

Every event log type has its own sub key, e.g.:

```
HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services\Event Log\System
```

Common event log types are:

- Application
- Security
- System

The event log type sub key has a “event source sub key” for every source name, e.g for the source name “Workstation”:

```
HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services\Event Log\System\Workstation
```

Note that the source name is case insensitive; so “Workstation” and “workstation” are considered equivalent.

#### 3.3.1. Event message strings

The event message strings are stored in event message files.

The event source sub key has a value named “EventMessageFile” which contains a path specification of the event message file.

```
%SystemRoot%\System32\netmsg.dll
```

Note that this value can contain multiple filenames separated by a semi colon (;) character and that the name of the event message files is case insensitive.

Here “%SystemRoot%” is case insensitive and needs to be expanded to the Windows directory. The actual value of %SystemRoot% can be found in the Registry value:

```
HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows NT\CurrentVersion\SystemRoot
```

This value is depended on the Windows version, e.g.

Value	Version
C:\WINNT35	Windows NT 3.5x
C:\WINNT	Windows NT 3.1, Windows NT 4.0 and Windows 2000 (NT 5.0)
C:\WINDOWS	Windows XP (NT 5.1) and later

Other placeholders that found to be used are:

```
%WinDir%
```

The actual value of e.g. %WinDir% can be found in the Registry value:

```
HKEY_LOCAL_MACHINE\System\CurrentControlSet\Control\Session  
Manager\Environment\windir
```

Event message files are PE/COFF executables that contains a resource (“.rsrc”) section. Event message files can have various extensions, e.g. “.exe”, “.dll”, “.dll.mui”, “.sys”.

The resource section contains a message-table resource which contains the event message strings. E.g.

```
C:\Windows\System32\netmsg.dll
```

The event message strings have identifiers similar to the event identifiers. E.g. if the event identifier is 3260 (0x00000cbc) the corresponding event message string would be:

```
This computer has been successfully joined to %1 '%2'.
```

The placeholder values %1 and %2 represent the first and second string in the event.

Note that the event message strings are language specific. An event message file can therefore contain event message strings for multiple languages.

### 3.3.2. Event category

The event category is primarily used in the Security event log. The category name strings are stored in event message files (also see: 3.3.1 Event message strings).

The event source sub key has a value named “CategoryMessageFile” which contains a path specification of the event message file.

```
%SystemRoot%\System32\MsAuditE.dll
```

The event category number corresponds to the event message strings in the event message file. The corresponding event message string should not contain a placeholder.

If there is no corresponding “CategoryMessageFile” the event category number should always be 0?

The value “CategoryCount” in the event source sub key contain the number of categories defined for the specific event source.

## 4. End of file record

The file header (ELF\_EOF\_RECORD) is 40 bytes of size and consists of:

offset	size	value	description
0	4	0x28	Size Including the size value
4	4	0x11111111	Signature1
8	4	0x22222222	Signature2
12	4	0x33333333	Signature3
16	4	0x44444444	Signature4
20	4		First (oldest) record offset
24	4		End of file record offset
28	4		Last (newest) record number
32	4		First (oldest) record number
36	4	0x28	Copy of size This value is used to indicate the end of the file header

## 5. Corruption scenarios

### 5.1. Dirty file with invalid offset values

In the dirty file with invalid offset values scenarios the file header indicates it is dirty and the first record offset and end of file record offset point to invalid locations in the file. The most likely cause for this scenario is that the file was in use but the header was not updated.

The approach to find the event records is to start looking for the end-of-file record after the the end-of-file record offset.

#### 5.1.1. Trailing non-event data

In the dirty file with invalid offset values scenarios it sometimes can happen that the file is wrapped and that there is trailing data after the last event before the wrap.

The approach to continue finding the event records is to ignore this trailing data.

### 5.2. Truncated event record

The data of the event record is not complete, part of the event record data is filled with 0-byte values. The copy of the record size is 0.

### **5.2.1. Truncated strings data**

If the the truncation occurs in the strings data part of the record can still be read.

The approach is to ignore the truncated part of the strings data.

### **5.3. *Event record with data offset is beyond record size***

Although the data offset does not seem to be 0, the value can be beyond the record size. As long as the data size is 0 the data offset can be safely ignored.

If the data is not 0, does this indicate the record has actual data and how to detect it?

## Appendix A. References

[MSDN]

Title: Event Logging Structures

URL: [http://msdn.microsoft.com/en-us/library/windows/desktop/aa363659\(v=VS.85\).aspx](http://msdn.microsoft.com/en-us/library/windows/desktop/aa363659(v=VS.85).aspx)

[NTSID]

Title: NT security descriptor definitions

URL: <https://downloads.sourceforge.net/project/libpff/documentation/MAPI%20definitions/NT%20security%20descriptor.pdf>

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