Windows 7/2008 Event Log forensic and reversing analysis
eseugutroP Reversed
2011/03/16 by ar1vr

This text refers to the 32bit version of Windows, unfortunately I don't have access to a 64bit development environment.

Opening an .evtx log is pretty straightforward, the only problem is that the *eventlog* service opens this files exclusively and if we try to make a copy, we'll get "Access is denied" error. So, we need to get them with the machine offline.

One of the reasons beyond the handles to this files being exclusively open, is that the *eventlog* service memory maps chunks of this files, holding and manipulating some housekeeping metadata information directly in the memory mapped files.
Performance and security issues also come to the discussion: the files aren't always in sync with the data in memory for example, and each file has an associated timer that CRCs the headers and flushes the mapped views. Also this metadata information allows for file recovery in case of unexpected shutdown or crash.

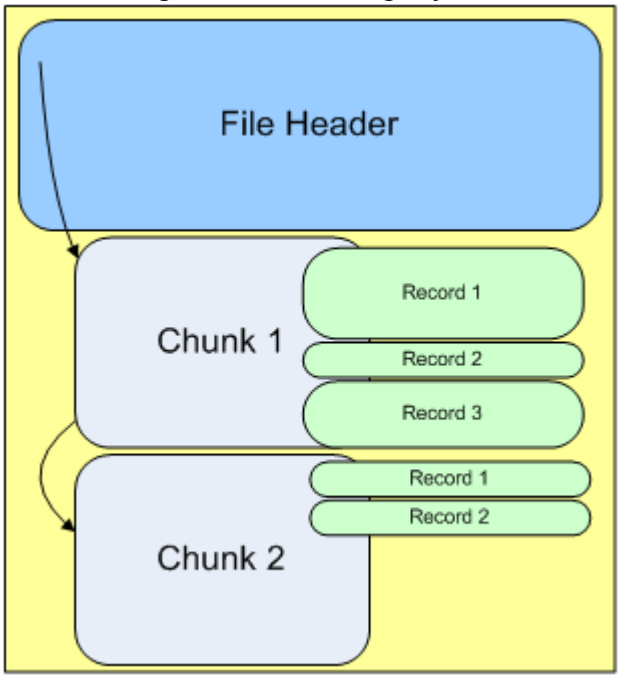
What this means for a "interested" person, is that we need to be careful if trying to change the logs content online, because not everything is what it seems. But it is indeed possible to manipulate the logs directly in memory: remove and change log entries, insert new entries, stealthily clear the logs, add log garbage, etc.
I wrote a small POC tool that shows this being done, I called it *Elchomp*. *Elchomp* basically clears the last log record entry in the event log of choosing. *Elchomp* is available with this document or at https://www.filesanywhere.com/fs/v.aspx?v=8a6b66865967747da3a5 .

The .evtx files are binary files, to where the *eventlog* service streams log records using XML templates to format each entry. This makes easier switching between the Event Viewer general and details panels.
These binary files are structured as follows:

- The file starts with a file header that describes the chunks used by the file. The stored information pertains to the number of chunks, the chunk size, and some duplicated information for failover purposes. A chunk is a container block of event records.
- N Chunks serialized. Each chunk points to a set of event log entries.
- N records. Each record represents an event log entry.

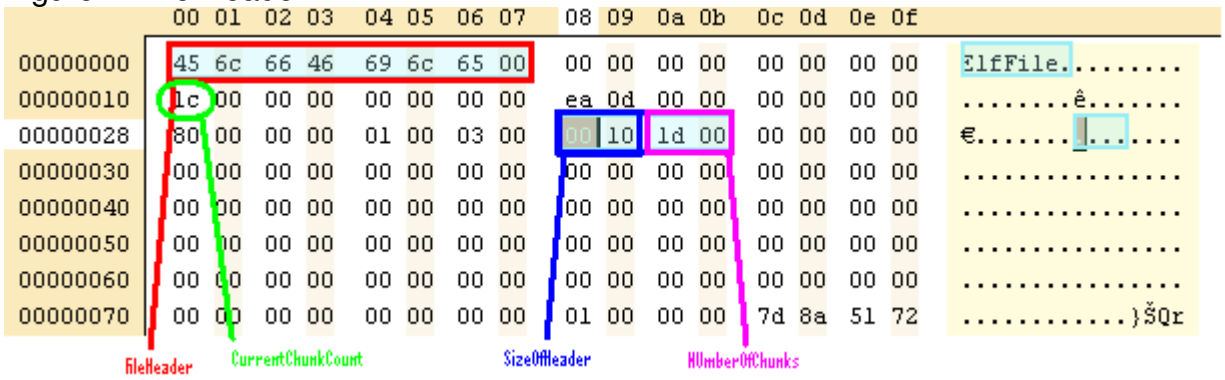
Let's view in more detail each of these structures. I'll cover only the most important data, so keep this in mind while reading. I'll open a real .evtx log for analysis. Figure 2 shows the first bytes of the file.

Figure 1: Event log layout



As can be seen, there are a couple of signatures in the file, the first signature "ElfFile" at position zero in the file, marks the beginning of the file, and is used to detect if this is an event log file type.

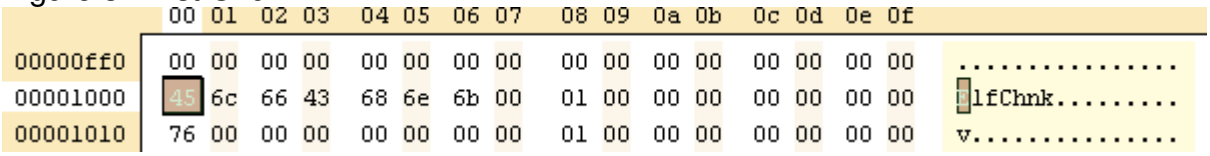
Figure 2: File Header



At offset 0x10 we have the *CurrentChunkCount*. This DWORD value doesn't show up in the *eventlog* file, I just mention it here because I wanted to enforce the differences between the offline and online layouts. When the log is opened by the *eventlog* service, the *CurrentChunkCount* is set to the chunk that the *NumberOfChunks* references, a new chunk is created and the *ChunkOffset* is updated accordingly.
At offset 0x28, *NumberOfChunks*, a WORD value, indicates how many chunks are in the file.
At offset 0x30, *SizeOfHeader* a WORD value, sets the size for the file header.
Positioning to the end of the File header, value 0x1000, we can see the first chunk

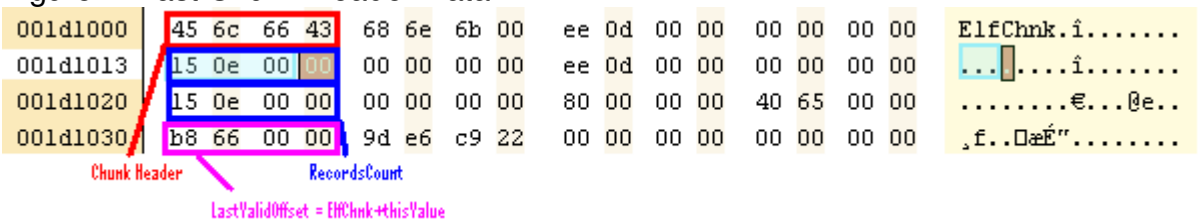
signature. (Figure 3)

Figure 3: First Chunk



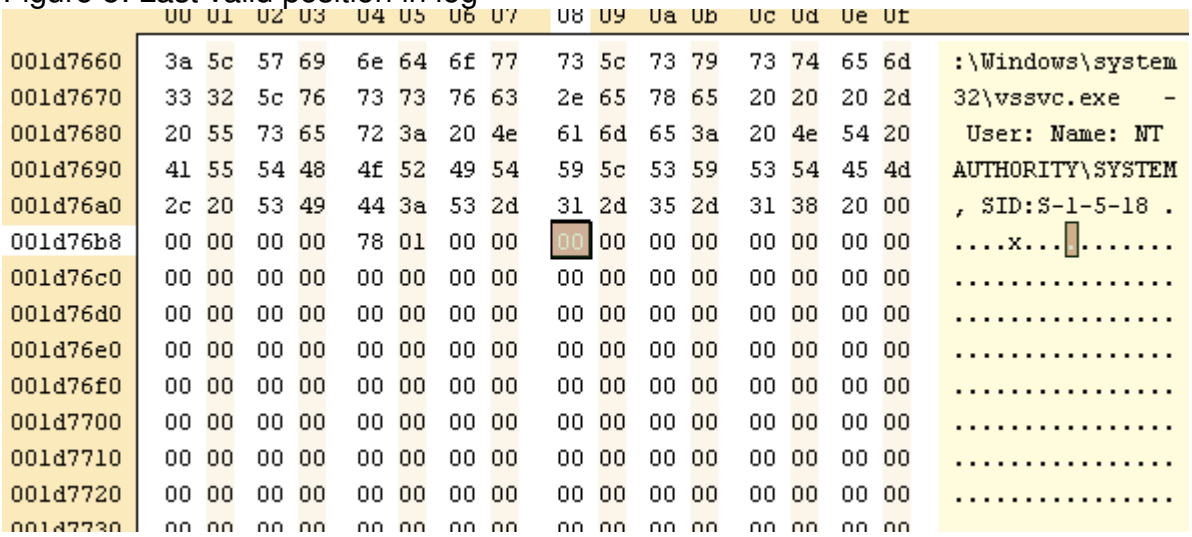
It's time to say that the chunks are fixed sized 0x10000 = 65536 bytes. The last chunk is always memory mapped in the *eventlog* service process.
Multiplying size of chunk by *NumberOfChunks* we get 0x10000*0x001d = 0x1d0000, sum the *FileHeader* and we get to last valid chunk header: 0x1d0000+0x1000 = 0x1d1000. (Figure 4)

Figure 4: Last Chunk Header Data



"ElfChnk" at position zero in the *ChunkHeader*, validates the chunk beginning.
At offset 0x10 and 0x20 we've got the same value, for failsafe purpose. It's a DWORD (0x00000e15) that represents the number of records contained in the chunk. Actually, if a new record is written it will use this value as Record counter, so the Number of records can be calculated by subtracting one to this value.
At offset 0x30 a DWORD that indicates the last offset position in the chunk that can be written to.

Figure 5: Last valid position in log

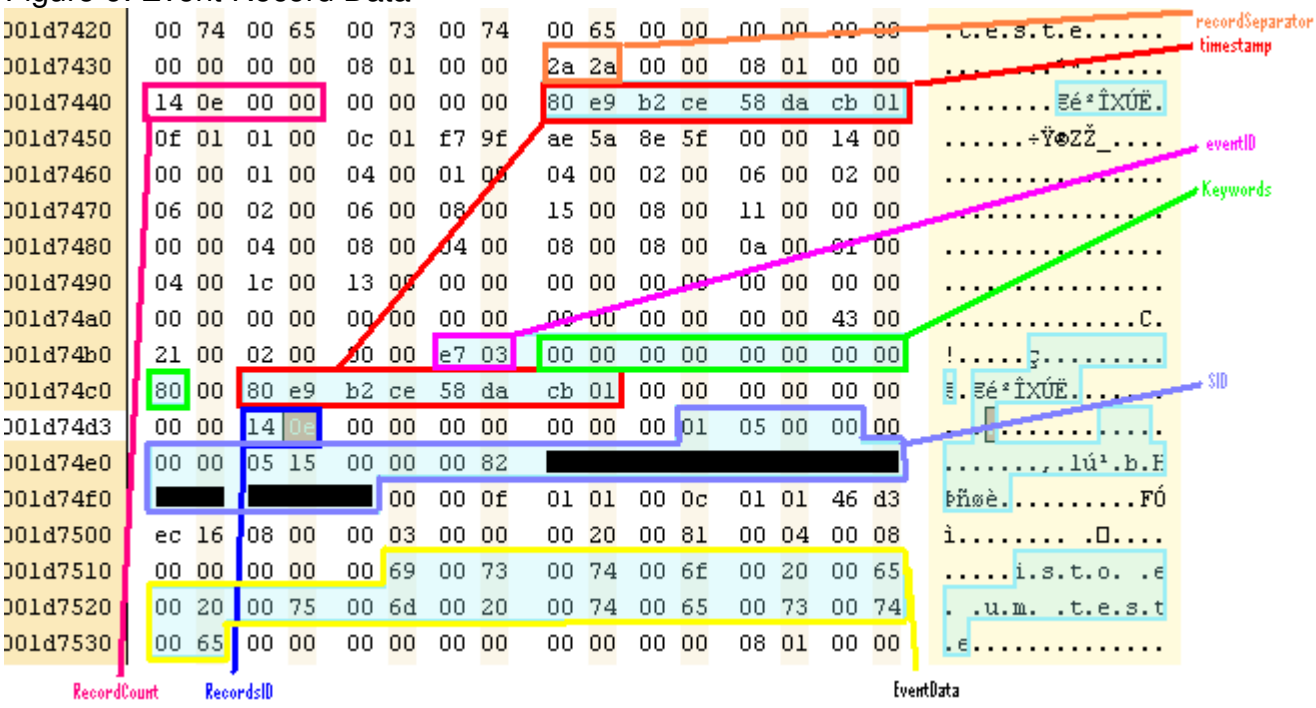


LastChunkStart = 0x001d1000
LastValidOffset = 0x000066b8
LastValidPosition = 0x001d1000 + 0x000066b8 = 0x001d76b8

From position 0x001d76b8 forward, there are only zeros. (Figure 5)

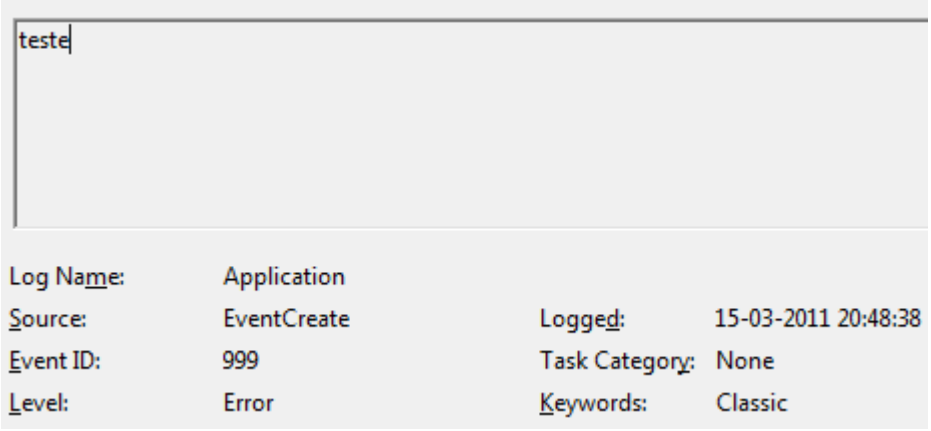
The last valid position also gives us the last valid record end. going backwards, we reach the signature (position 0x1d7438 in figure 6) for the last event record '**' or 0x2A2A.

Figure 6: Event Record Data



At offset 0x6 we find the current record count 0xe14 (being this the last valid record in the chunk this value is equal to the chunk's number of records minus one).
At offset 0xe and 0x86 the timestamp in file format. Corresponds to the event viewer's "Logged" time field.
At offset 0x7a the Event Id.
At offset 0x7e the Keywords field.
At offset 0x96 the record Id.
At offset 0x9e the SID.
At offset 0xda we've got the log message.

Figure 7: Event Viewer log entry



Hope you enjoyed