

(U//FOUO) Persistence Specification

(U//FOUO) Specification 003: version 1

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1. (U//FOUO) Overview

(U//FOUO) This specification exists to provide a common interface while preventing the use of other, more sensitive, execution specifications in persistence scenarios. It is not expected that this will be the only persistence interoperability mechanism implemented by the Sponsor, instead this specification provides a default.

(U//FOUO) Persistence modules consist of a Loader which utilizes a persistence technique (either hard or soft) and a payload to launch after a reboot or other execution ending event. Both pieces are exposed and vulnerable to hostile scrutiny and so must be simple, lack any definite attribution indicators, and easy to replace.

(U//FOUO) Payload modules are Windows DLLs with at least one entry point defined, `DllMain`.

2. (U//FOUO) Loading and Invocation

1. (U//FOUO) The Persistence Loader gains execution through its persistence technique and causes the payload to be loaded into an appropriate process via `LoadLibrary` or equivalent technique.
 - a. (U//FOUO) The Loader should apply the default memory page permissions for a module's sections (i.e., as would be set by `LoadLibrary`). This prevents a single large chunk of `PAGE_EXECUTE_READWRITE` memory which could easily be found by memory forensics.
2. (U//FOUO) From `DllMain` the payload spawns a new thread to execute its main code. `DllMain` otherwise behaves as per the MSDN documentation, to include return values. This is done to comply with the MSDN documentation of `DllMain`'s execution environment.
3. (U//FOUO) If possible the Loader responds to `DllMain`'s exit status as per the MSDN documentation. If the payload is to be unloaded then the memory the payload occupied is zeroed afterwards.
 - a. (U//FOUO) Not all persistence techniques permit the Loader to collect this exit status. If a particular technique does not make this easy then the Loader may ignore this return value and so leak it. Because this leak occurs approximately once per boot this is acceptable.

3. (U//FOUO) Arguments

(U//FOUO) If a payload expects arguments then it must define an expected environment variable name in its documentation. Prior to calling `DllMain` the Loader will set this environment variable to a null terminated string (`wchar_t`) representation of the command line arguments. This representation will not include an `argv[0]` placeholder. For example, a payload that reads input from one parameter named file and writes output to a second parameter specified file might define `WINDBG_LOG` to be its

environment variable and so would be invoked by the loader with an environment including WINDBG_LOG="c:\fileone.txt c:\filetwo.log".

(U//FOUO) The user is responsible for conveying both the expected variable name and the command line arguments to the Loader's configuration component prior to deployment.

(U//FOUO) Because few tools require this behavior it is optional for payloads. Loaders must support executing payloads without arguments without creating a dummy environment variable. In all cases a payload requiring arguments must support some reasonable behavior when invoked without expected arguments (e.g, quitting gracefully).

4. (U//FOUO) Structured Exception Handling

(U//FOUO) Loaders will not provide fix ups to allow payloads to use Structured Exception Handling (SEH). If a payload wishes to use SEH it must perform the fix ups itself.

5. (U//FOUO) Uninstallation

(U//FOUO) This specification explicitly does not define a mechanism for the payload to communicate to the loader that it should be removed. This is because persistence techniques vary so widely that a single standard could not reasonably accommodate all of the possible cases. The only requirement that this specification applies is that loaders must provide some mechanism for a user to de-persist a given payload.

(U//FOUO) Appendix A: Version History

(U//FOUO) Version 1: Initial publication