

Grasshopper v1.1 Administrator Guide

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1 Catalog Management and Writing

1.1 Introduction

The Grasshopper catalog files define all of the persistence modules and payloads that are available for an operator to build an operation. They define all the values needed by Grasshopper to verify compatibility, and to merge them with the prebuild grasshopper binaries. Catalog files contain one or more module descriptions and all file paths contained in the descriptions must be either complete paths or relative to the location of the catalog file.

1.2 File Structure

The Grasshopper system stores all of its files in a relative file structure that allows the users to define new rules and catalog files that will be automatically loaded whenever the Grasshopper or Cricket builders are executed. Below is a listing of the Grasshopper file structure:

Binaries

The binaries directory contains all of the precompiled binary files that are used in the Grasshopper build process. It should not be modified by users or administrators for any reason.

Grasshopper

The grasshopper directory contains the Python package used for all of the provided Python scripts. It should not be modified by users or administrators for any reason.

Modules

The modules directory contains a series of folders for all of the delivered Persistence Modules. The Persistence Module folders contain the corresponding catalog files, specific rulefiles, stub files, and the module binaries. This directory is scanned by both builder scripts at startup and is where any new persistence module catalog files should be added.

Payloads

The payloads directory contains a series of folders for all of the delivered Payloads. The Payload folders contain the corresponding catalog files and specific rule files. This directory is scanned by both builder scripts at startup and is where any new payload catalog files should be added.

Rules

The rules directory contains all of the common rules that are used across the payload and persistence modules. Great care should be taken when modifying any of the files in this directory as it may render unexpected modules inoperable.

1.3 XML Format

1.3.1 XML Example

```

<Grasshopper version='1.0'>
<Catalog>
<Payload>
<Name>Assassin DLL-32</Name>
<Description>Assassin 1.1 32 dll, doesn't include persistence</Description>
<RuleData>
<DefaultRule>asn.rule</DefaultRule>
<OverrideRuleuuid='6578ece4a8634d88924fd8f223c3d3ec' name='buffalo-32'>..\..\Rules>true.rule</OverrideRule>
<OverrideRuleuuid='05921fcde5194f668d5f4eb9d79a219b' name='bamboo-32'>..\..\Rules>true.rule</OverrideRule>
<OverrideRuleuuid='f329431bf7e647a486ef497218c65a67' name='netman-32'>..\..\Rules>true.rule</OverrideRule>
</RuleData>
<UUID>f00ca407f88649c88e7204d4d7bd4382</UUID>
<Type bitness="32" format="dll" run_level="system"/>
<Parameters prompt='no' />
<Obfuscate type='reorder'>
<MinBlockSize>50</MinBlockSize>
<MaxBlockSize>100</MaxBlockSize>
</Obfuscate></Payload>

<PersistenceModule>
<Name>Crab DLL-32 (GH1)</Name>
<Method>Standalone Service</Method>
<Description>Windows Service Executable</Description>
<Interface>gh1</Interface>
<Rule>crab.rule</Rule>
<Handler>crab.py</Handler>
<Binary32>..\common\PM-Registry-32.dll</Binary32>
<Binary64>..\common\PM-Registry-64.dll</Binary64>
<Stub>
<Type format="exe" bitness="32" />
<LocalFilePath>Stub-ServiceExe-Memory-GH1-32.exe</LocalFilePath>
</Stub>
<UUID>533eb9283e34414e8e1663d46af9d350</UUID>
<Settings>
<RunMode>memory</RunMode>
</Settings>
<SupportedTypes>

```

```
<Type format="dll" bitness="32" run_level="system"/>  
</SupportedTypes>  
</PersistenceModule>  
</Catalog>  
</Grasshopper>
```

1.3.2 Field Definitions

Binary32

The Binary32 tag contains the file path, relative or complete, to the 32-bit binary file for the persistence module. The file is executed on the target device, and is responsible for setting up the persistence and executing the payload.

In the example above, the binary 32 tag is set to “..\common\PM-Registry-32.dll”.

Binary64

The Binary64 tag contains the file path, relative or complete, to the 64-bit binary file for the persistence module. The file is executed on the target device, and is responsible for setting up the persistence and executing the payload.

In the example above, the binary 32 tag is set to “..\common\PM-Registry-64.dll”.

Description

The Description field contains a details description of the module it's contained within, but it will only be displayed during a detailed print of the catalog or applied modules.

In the examples above, the descriptions provided in the two modules are:

- Assassin 1.1. Injection Extractor, includes persistence
- Runs payload as on-disk exe

Handler

The Handler tag contains the file path, relative or complete, to the Python handler file responsible for all persistence module specific processing. This only exists in persistence modules and is required for the module to function properly. For more information on class files, see the user manual section on persistence module handlers.

Interface

The Interface tag describes the interface that the module has been built to use. The interface defines the methods for how Grasshopper will load, deploy, and uninstall the payload. An interface is required for all catalog modules. For more information on interfaces see the user manual section on grasshopper interfaces.

In the examples above, the Interface fields provided in the example are both set to 'run_once', defining that grasshopper will only run the payload on execution and not provided any additional persistence.

Method

The method type tag describes the persistence method the module employs. This field exists in both the payload and persist modules and is completely informative and optional. It is not included in the final binary and has no effect on the final build.

In the examples above, the methods described in the two modules are:

- Service Injection
- Standalone service

Module Type

The module type tag describes the type of the catalog module that will be described within. Currently the only supported module types are “Payload” and “PersistenceModule”. An example of both types is shown above.

Name

The Name field contains the name of the catalog entry that will be displayed in the builder and the various XML files. It can be any string that describes the module described in the entry.

In the examples above, the names provided in the two modules are: “Assassin Injection Extractor” and “Null Persist”.

Obfuscate Type

The Obfuscate tag defines whether or not Grasshopper should apply an obfuscation method to the binary. This tag is optional, and if not provided, the binary will be left in the clear. For more information on binary obfuscation see the user manual section on obfuscation.

In the examples above, the payload module is set to have its binary obfuscated using the “reorder” technique using a block size range of 50 to 100 bytes. The persistence module has no obfuscate tag and it will be left in the clear.

Parameters

The Parameters field tells Grasshopper whether the payload needs parameters of any kind. If the prompt value is set to “no”, the user will not be prompted. In any case, if a “Default” tag is within the Parameters tag, the parameter value will be initialized to that value. There is also an option to define a Usage value that defines the usage string that will be displayed when the user is prompted for the parameters value.

In the example above, the payload module sets the prompt attribute to “no”, and there is no default value defined, so this module doesn’t require any parameters to execute.

Rule

The Rule tag contains the file path, relative or complete, to the rule file that will be processed before the module is deployed. A rule file is required for all Persistence Modules.. For more information on rule files see the user manual section describing rule files.

In the example above, the rule is set to “crab.rule”.

Rule Data

The Rule Data tag is only used in Payload Modules and it consists of a required Default Rule tag and optional Override Rule tags. The Default Rule defines the

rule that will be applied by default whenever the payload is executed. The Override Rule tags define a series of optional overrides based on the persistence module that is included in the rule. At build time, if a Persistence module with a UUID that matches one of the override rules, that rule will be applied instead of the default.

In the example above, the default rule is set to "asn.rule", and there are three override rules that change the rule to "..\..\Rules>true.rule".

Settings

The Settings tag is only used in Persistence Modules and it defines information that is provided to the Persistence Module binary. The child tags are all arbitrary and completely optional.

In the example above, the Settings tag has a child tag of "RunMode", which is specific to the Grasshopper 1.0 persistence modules and it tells the module if the payload will be dropped to disk or loaded directly into memory.

Stub

The Stub tag contains the file path, relative or complete, to the stub file for the persistence module and a type definition which defines a series of arbitrary file description values. The field only exists in Persistence Module entries and is optional. The stub file is executed on the target device, and is responsible for executing the payload and maintaining persistence, if applicable.

In the example above, the StubLocal File Path tag is set to "Stub-ServiceExe-Memory-GH1-32.exe" and the Stub Type flag describes the file as being a 32-bit executable file.

Supported Types

The Supported Types tag contains all of the type combinations that are supported by the Persistence Module. The tag is required and must contain at least one child entry. For a more detailed description of the child entries, see the Type tag description below.

In the example above, the Persistence Module only supports one type:

- `<Type format="dll" bitness="32" run_level="system"/>`

Type

The Type tag is used differently in Payload and Persistence Module entries. In Payload entries, the type tag provides details about the payload binary that grasshopper uses to determine compatibility with the provided persistence modules. The Persistence Module entry will contain one or more type specifications within the Supported Types flag. This allows a persistence module to support more than one type description without requiring multiple catalog entries. The attributes of the Type field are completely arbitrary, and not dependent on order, but must match in order to apply a persistence module to a payload module.

In the examples above, the Payload module has a type field defining "bitness=32 format=exe run_level=system". This tells Grasshopper that the

payload is a 32-bit executable binary that must be ran as system. The persistence module supports two types; 32-bit and 64-bit executable ran as system. Due to this, the modules are compatible and could be used in a Grasshopper build.

UUID

The UUID tag defines a universally unique identifier for the catalog entry. The field is required for all catalog entries and must be unique across all catalogs. If a second module is loaded with a UUID that has already been loaded, the second entry will be ignored.

In the example above, the UUID is set to "533eb9283e34414e8e1663d46af9d350".

1.4 Obfuscation

Although Grasshopper 1.0 doesn't encrypt the payload data, it does provide a series of obfuscation techniques to hide the payload from the PSPs. These techniques allow for Grasshopper to contain known "bad" binaries that are normally flagged by PSPs without any issue. The two obfuscation methods included in Grasshopper 1.0 are described below:

1.4.1 Reorder

The reorder obfuscation technique was primarily designed to mask PE headers from the initial scans of PSPs. The technique uses a randomized block size, with min and max size defined in the catalog entry, and it swaps out all of the chunks so the first chunk ends up being the last. In testing, this method has been very successful in bypassing the PSP initial scans with no issues. To use this method, set the "Obfuscate" tag to type "reorder". An example of this is shown below:

```
<Obfuscate type='reorder'>  
<MinBlockSize>50</MinBlockSize>  
<MaxBlockSize>100</MaxBlockSize>  
</Obfuscate>
```

In the example above, the module will be set to use reorder obfuscation and the block size used will be a random value between 50 and 100 bytes.

1.4.2 XOR

The XOR obfuscation technique is a common technique used to mask strings and binary formats. The technique generates random 4 byte block which is then XOR'd with the module data. In testing, PSPs deem larger binaries as suspicious and it raises the Grasshopper binary's profile. It is recommended that this technique should only be used for small data files or configurations. For all other files use the reorder obfuscation technique which is described above. To use this method, set the "Obfuscate" tag to type "xor". An example of this is shown below:

```
<obfuscate type='xor' />
```

In the example above, the module will be set to use xor obfuscation.

1.5 Best Practices

1.5.1 Creating new Catalogs

All new catalogs should be generated in either the Payloads or Modules directory; otherwise they will not be loaded at builder start. It is possible to add a catalog file manually using either command line options or a builder command, but this is not recommended for any catalogs that may be useful to other users.

1.5.2 Modifying the Delivered Catalogs

The delivered catalog files should only be modified if the change is universal and should be used on all future operations. An example of this is if a PSP starts flagging a specific payload or persistence module. For any cases that are specific to an operation or testing, a new catalog can be created and left in the folder. That way the new specific catalog will be auto loaded at builder start, but the original catalogs will be unperturbed for future operations.

1.5.3 Managing Catalog Changes

The Grasshopper team highly recommends storing the Payload, Persistence Modules, and Rules in some type of source control engine. This will allow the users to revert back to earlier catalog iterations to assure the re-creation of operations and to undo entry changes.

2 Rule Management and Writing

2.1 Introduction

Grasshopper rules are used to perform a pre-installation survey of the target device, assuring that the payload will only be installed if the target has the right configuration. A rule can be as simple as a single true statement, or highly complex with layers of logical statement. In either case, every rule results in a single return code of: True, False, or Invalid. Invalid is a special case where an issue occurred during the gathering of the fact that makes the result indeterminate. If the final result of a rule is an Invalid, the rule will be treated as if it failed, and the system will move to the next payload, if available.

Every Grasshopper module, payloads and persist modules, require a rule. The only exception to this is the Cricket builder, which generates an installation that ignores all rules and installs the payload and persist module blind. The following section will describe the custom Grasshopper Rule language and provide best practices for updating existing or writing new rules.

2.2 Grammar Description

2.2.1 Operators

The Grasshopper Operators describe the logical methods that can be applied to sets of child rules. This allows the rule writer to generate more complex rule sets that allows for multiple scenarios, not just a simple set of true false statements.

Grasshopper currently supports two different operator formats based on the number of child rules that can be applied. Descriptions of the two formats are described in the sections below.

Standard Operators

The Grasshopper standard operators take in one or more child rules and always result in a single return value that is a culmination of the child rule results combined using a logical method. The operators support the possibility of a "short circuit" situation where, based on a portion of the child rule results, the return value for the operator can be established without evaluating any more child rules. The format for a standard operator is shown below:

```
<operator> {
<child rule 1>
...
<child rule n>
}
```

A list of the current standard operators is provided in Operator Descriptions.

Unary Operators

The Grasshopper unary operators take in a single child rule and always result in a single return value that applies a logical method to the result of the child rule. These operators do not have the capability to short circuit due to having a single child rule. The format for a unary operator is shown below:

```
<operator><child rule 1>
```

A list of the current unary operators is provided in Operator Descriptions.

2.2.2 Facts

The Grasshopper Facts describe the survey values that can be validated at run time. These values range from Grasshopper specific information to target network connectivity. A fact consists of a noun and a verb separated by a period.

The noun represents a general description of the data available in its supported verbs. For example, the “network” noun contains all verbs that relate to the target network connectivity and setup. In addition, nouns support parameters. These parameters are optional and are used to define specific information related to the noun. For example, the “directory” noun takes in one parameter, the directory that the verb will be referencing.

The verb describes the specific piece of information being referenced by the fact. For example, the “exists” verb checks to see if the data described in the noun exists on the target system. Just like the noun, the verb optionally supports parameters. The format for a fact is shown below:

```
<noun>( <optional params> ). <verb>( <optional params> )
```

The “<optional params>” values can be skipped for nouns and verbs that don’t take parameters. A description of all of the facts available in Grasshopper is included in Operator Descriptions.

2.2.3 Variables

The Grasshopper rule grammar supports the use of variables within rule files. The variables must be listed before any rules, and they must be upper case. The rule grammar replaces each instance of the variable within the rules with the exact text provided in the variable definition. The variable definition format is shown below:

```
<variable name>=<variable value>
```

Rule variables are completely optional but can be very helpful when writing larger rule files.

2.2.4 Comments

The Grasshopper rule grammar supports comments within rule files. The comments must take up the entire line, excluding spaces, and must begin with a "#". They can be embedded anywhere within the rule file, including before, after, and within the rules and operators. The rule grammar comment format is shown below:

```
# <comment>
```

For further examples of rule comments can be seen in the delivered Grasshopper rule files.

2.3 Best Practices

2.3.1 Modifying the Delivered Rules

The delivered rule files should only be modified if the change is universal and should be used on all future operations. An example of this is if a PSP changes its profile, thus negating the PSP validation rules. For any cases that are specific to an operation or testing, a new rule file should be created and left in the folder specific to the operation.

2.3.2 Creating new Rules

All new rule files should be generated in either the common Rules directory or under the specific module directory the rule is being created for. If the rule is a general change that will be used across multiple operations, i.e. PSP update, the rule file should be placed in the common directory. If the rule is specific to an operation, the file should be located in either the operational specific payload or persist module directory.

2.3.3 Managing Rule Changes

The Grasshopper team highly recommends storing the Payload, Persistence Modules, and Rules in some type of source control engine. This will allow the users to revert back to earlier rule iterations to assure the re-creation of operations and to undo entry changes.

2.3.4 Managing Short Circuits

The Grasshopper rule engine supports operator short circuiting to greatly reduce the number of rules that need to be evaluated. A short circuit occurs when an operator receives a return value from a fact that guarantees the outcome of the operator. For example, if an “and” operator receives a result of false from any child fact, the end result of the operator will always be false. Due to this, the rule engine will stop evaluation of the remaining child rule for the operator and return. The short circuit situation for each operator is described below in Operator Descriptions.

When writing rules, the rule writer needs to take the short circuit situations into account. For example, when using the “and” operator, the rule writer should place the rules that are most commonly false at the beginning, to assure the minimal number of rules will be evaluated.

2.3.5 Rule Documentation

The Grasshopper rule engine supports variable substitution and in-line comments. Variable substitution can be very helpful when a certain string is repeated multiple times in the rule. An example of this is shown below:

```
RULE_DIR=..\..\Rules

# Doesn't work on Rising for vista and newer when the system is deactivated
not and {
    os.at_least(vista-sp0)
    rule.import(RULE_DIR\rising.rule)
    notos.activated
}
```

In the above example, the imported rule files are stored in the common rule directory. A variable was created for the common rule directory, which simplified the rule generation and it centralizes the value, so if it changes in the future, it will be easier to update. In addition to the variable, a comment was added to describe the reason for the rule values, which can be especially helpful for non-intuitive rule entries.

2.3.6 Use Imported Rules

The Grasshopper rule ending provides a mechanism for keeping common rule sets in a central location, which can then be imported to other rule files. An example of this is shown below:

```
and {
  rule.import(..\..\Rules\is-32.rule)
  rule.import(extractor.rule)
}
```

In the above example, the rule consists of an “and” operator that combines two imported rules: “is-32.rule” and “extractor.rule”. The “is-32.rule” is imported from the common rule directory and is shown below:

```
os.bitness(32)
```

The above rule validates that the target operating system is 32-bit. The next import is a payload specific rule shown below:

```
RULE_DIR=..\..\Rules
and {
  rule.import(RULE_DIR\am-admin.rule)
  rule.import(RULE_DIR\no-avira.rule)
  or {
    # Flagged by 32-bit rising, not 64-bit
    rule.import(RULE_DIR\no-rising.rule)
    rule.import(RULE_DIR\is-64.rule)
  }
}
```

The above rule runs an additional series of imports combined by multiple operators. This example shows how the rule writer can centralize common rule values, and then bring them together for use in multiple payloads and persist modules.

Appendix A: Change Log

Date	Change Description	Authority
05/2012	Document Initialization	235567 9
09/2012	Update for Grasshopper v1.0 Phase 2 Delivery	235567 9
11/2012	Update for Grasshopper v1.0.1 Delivery	235567 9

Appendix B: Operator Descriptions

1 And

Description

The “and” operator allows for one or more embedded rules. If any of the embedded rules returns False, the operator will return false. If no false rules are embedded, but one rule returns invalid, an invalid will return. Otherwise it will return true.

Short Circuit

If at any point during processing of the embedded rules, a false is discovered, the remaining rules will be ignored and the operator will return false.

Usage

```
and {
    <rule>
    ...
}
```

Example

```
and {
    grasshopper.bitness(32)
    grasshopper.access_at_least("admin")
}
```

The above example will return true only if the grasshopper binary is 32-bit and the run level is administrator or higher.

Return Values

Return Code	Description
True	All embedded rules are true
False	One or more embedded rules returns false
Invalid	No embedded rules return false and at least one returns invalid

2 Assume False

Description

The “assume_false” operator is a unary operator and allows for only one embedded rule. If the embedded rule returns invalid, the operator will return false, otherwise it will return whatever the embedded rule returns.

Short Circuit

N/A

Usage

```
assume_false<rule>
```

Example

```
assume_falsetos.bitness(32)
```

The above example will return false if the embedded rule returns an invalid. Otherwise it will return the result of the os.bitness rule.

Return Values

Return Code	Description
True	Embedded rule returns true
False	Embedded rule returns false or invalid
Invalid	N/A

3 Assume True

Description

The “assume_true” operator is a unary operator and allows for only one embedded rule. If the embedded rule returns invalid, the operator will return false, otherwise it will return whatever the embedded rule returns.

Short Circuit

N/A

Usage

```
assume_true<rule>
```

Example

```
assume_trueos.bitness(32)
```

The above example will return true if the embedded rule returns an invalid. Otherwise it will return the result of the os.bitness rule.

Return Values

Return Code	Description
True	Embedded rule returns true or invalid
False	Embedded rule returns false
Invalid	N/A

4 Not

Description

The “not” operator is a unary operator and allows for only one embedded rule. The operator will switch the results of the embedded rule unless an invalid is returned. If the embedded rule returns an invalid, the operator will return invalid as well.

Short Circuit

N/A

Usage

```
not<rule>
```

Example

```
notos.bitness(32)
```

The above example will return invalid if the embedded rule returns an invalid. Otherwise it will return the opposite of the result of the os.bitness rule.

Return Values

Return Code	Description
True	If the embedded rule returns false
False	If the embedded rule returns true
Invalid	If the embedded rule returns invalid

5 Or

Description

The “or” operator allows for one or more embedded rules. If any of the embedded rules returns true, the operator will return true. If no true rules are embedded, but one rule returns invalid, an invalid will return. Otherwise it will return false.

Short Circuit

If at any point during processing of the embedded rules, a true is returned, the remaining rules will be ignored and the operator will return true.

Usage

```
or {
  <rule>
  ...
}
```

Example

```
or {
  grasshopper.bitness(32)
  grasshopper.access_at_least("admin")
}
```

The above example will return true if either the grasshopper binary is 32-bit or the run level is administrator or higher.

Return Values

Return Code	Description
True	One or more embedded rules returns true
False	All of the embedded rules return false
Invalid	No embedded rules return true and at least one returns invalid

6 Xor

Description

The “xor” operator allows for one or more embedded rules. If only one of the embedded rules returns true, the operator will return true. If more than one embedded rule returns true, the operator will return false. Otherwise, if an embedded rule returns invalid, and the operator would normally return false, it will return invalid.

Short Circuit

If at any point during processing of the embedded rules, more than one true is returned, the remaining rules will be ignored and the operator will return false.

Usage

```
xor {
  <rule>
  ...
}
```

Example

```
xor {
  grasshopper.bitness(32)
  grasshopper.access_at_least("admin")
}
```

The above example will return true if either the grasshopper binary is 32-bit or the run level is administrator or higher, but not both. If either rule returns an invalid, the operator will return invalid due to the inability to guarantee the rule isn't true.

Return Values

Return Code	Description
True	If one and only one embedded rule returns true, and there are no invalids.
False	If more than one true is returned. If no invalid have been found, and no true results have been returned.
Invalid	If either no embedded rules return true or one returns true, and at least one returns invalid.

Appendix C: Fact Descriptions

1 Directory

Description

The “directory” noun takes in a single directory path parameter that all of the corresponding verbs are applied against. All supported verbs are related to data and interactions with the target file system directories.

Usage

```
directory(<directory path>).<verb data>
```

Example

```
directory("c:\windows").<verb data>
```

The above example applies the “c:\windows” directory path to the noun, which will then be used in conjunction with whatever verb is applied.

1.1 AccessedAfter

Description

The “accessed_after” verb takes in a single date parameter and verifies that the provided directory was last accessed after the provided date. The date must be in either ISO 9601 format, 2012-01-01T12:00:00 or 2012-01-01.

Usage

```
directory(<directory path>).accessed_after(<timestamp>)
```

Example

```
directory("c:\windows").accessed_after("2012-01-01")
```

The above example verifies that the provided directory was accessed after January 1st, 2012 at midnight.

Return Values

Return Code	Description
True	Path exists, is a directory, and meets the criteria
False	Path exists, is a directory, and doesn't meet the criteria
Invalid	Path does not exist or is not a directory

1.2 AccessedBefore

Description

The “accessed_before” verb takes in a single date parameter and verifies that the provided directory was last accessed before the provided date. The date must be in either ISO 9601 format, 2012-01-01T12:00:00 or 2012-01-01.

Usage

```
directory(<directory path>).accessed_before(<timestamp>)
```

Example

```
directory("c:\windows").accessed_before("2012-01-01")
```

The above example verifies that the provided directory was accessed before January 1st, 2012 at midnight.

Return Values

Return Code	Description
True	Path exists, is a directory, and meets the criteria
False	Path exists, is a directory, and doesn't meet the criteria
Invalid	Path does not exist or is not a directory

1.3 Contains

Description

The “contains” verb takes in a name of a file or directory and a depth. If a file exists in the provided directory, or within sub-directories up to the provided depth, it will return true.

Usage

```
directory(<directory path>).contains(<file name>, <depth>)
```

Example

```
directory("c:\windows").contains("notepad.exe", 3)
```

The above example will search the directory: “c:\windows” and up to three sub levels looking for a file called “notepad.exe”.

Return Values

Return Code	Description
True	A matching file is found anywhere within the search area
False	No matching file is found in the search area
Invalid	An error (including ACCESS_DENIED) occurred, and the file was not otherwise found

1.4 ContainsIgnore

Description

The “contains_ignore” verb takes in a file or directory and a depth. This verb works just like “contains” except that it ignores the “ACCESS_DENIED” errors.

Usage

```
directory(<directory path>).contains_ignore(<file name>, <depth>)
```

Example

```
directory("c:\windows").contains_ignore("notepad.exe", 3)
```

The above example will search the directory: “c:\windows” and up to three sub levels looking for a file called “notepad.exe”.

Return Values

Return Code	Description
True	A matching file is found anywhere within the search area
False	No matching file is found in the search area
Invalid	An error occurred, and the file was not otherwise found

1.5 CreatedAfter

Description

The “created_after” verb takes in a single date parameter and verifies that the provided directory was created after the provided date. The date must be in either ISO 9601 format, 2012-01-01T12:00:00 or 2012-01-01.

Usage

```
directory(<directory path>).created_after(<timestamp>)
```

Example

```
directory("c:\windows").created_after("2012-01-01")
```

The above example verifies that the provided directory was created after January 1st, 2012 at midnight.

Return Values

Return Code	Description
True	Path exists, is a directory, and meets the criteria
False	Path exists, is a directory, and doesn't meet the criteria
Invalid	Path does not exist or is not a directory

1.6 CreatedBefore

Description

The “created_before” verb takes in a single date parameter and verifies that the provided directory was created before the provided date. The date must be in either ISO 9601 format, 2012-01-01T12:00:00 or 2012-01-01.

Usage

```
directory(<directory path>).created_before(<timestamp>)
```

Example

```
directory("c:\windows").created_before("2012-01-01")
```

The above example verifies that the provided directory was created before January 1st, 2012 at midnight.

Return Values

Return Code	Description
True	Path exists, is a directory, and meets the criteria
False	Path exists, is a directory, and doesn't meet the criteria
Invalid	Path does not exist or is not a directory

1.7 Empty

Description

The “empty” verb takes in no parameters and will return true only if the directory contains no files or directories other than “.” and “..”.

Usage

```
directory(<directory path>).empty
```

Example

```
directory("c:\windows").empty
```

The above example checks to see if the “c:\windows” directory contains no files or sub-directories.

Return Values

Return Code	Description
True	The directory exists, is readable, and has no files or subdirectories
False	The directory exists, is readable, and has files or subdirectories
Invalid	The directory doesn't exist or is not readable

1.8 Exists

Description

The “exists” verb takes in no parameters and will return true if the directory provided exists and is a directory

Usage

```
directory(<directory path>).exists
```

Example

```
directory("c:\windows").exists
```

The above example checks to see if the “c:\windows” directory exists and is a directory.

Return Values

Return Code	Description
True	The path exists and is a directory
False	The path doesn't exist
Invalid	Access denied or the path exists but is not a directory

1.9 ModifiedAfter

Description

The “modified_after” verb takes in a single date parameter and verifies that the provided directory was modified after the provided date. The date must be in either ISO 9601 format, 2012-01-01T12:00:00 or 2012-01-01.

Usage

```
directory(<directory path>).modified_after(<timestamp>)
```

Example

```
directory("c:\windows").modified_after("2012-01-01")
```

The above example verifies that the provided directory was modified after January 1st, 2012 at midnight.

Return Values

Return Code	Description
True	Path exists, is a directory, and meets the criteria
False	Path exists, is a directory, and doesn't meet the criteria
Invalid	Path does not exist or is not a directory

1.10 ModifiedBefore

Description

The “modified_before” verb takes in a single date parameter and verifies that the provided directory was modified before the provided date. The date must be in either ISO 9601 format, 2012-01-01T12:00:00 or 2012-01-01.

Usage

```
directory(<directory path>).modified_before(<timestamp>)
```

Example

```
directory("c:\windows").modified_before("2012-01-01")
```

The above example verifies that the provided directory was modified before January 1st, 2012 at midnight.

Return Values

Return Code	Description
True	Path exists, is a directory, and meets the criteria
False	Path exists, is a directory, and doesn't meet the criteria
Invalid	Path does not exist or is not a directory

1.11 OwnedBy

Description

The “owned_by” verb takes in a single parameter describing the user to check for ownership. The fact will return true only if the directory is owned by the provided user.

Note: doesn't include the DOMAIN.

Usage

```
directory(<directory path>).owned_by(<user name>)
```

Example

```
directory("c:\windows").owned_by("admin")
```

The above example checks to see if the “c:\windows” directory is owned by the user “admin”.

Return Values

Return Code	Description
True	If the path exists, is a directory, and the owner matches
False	If the path exists, is a directory, and the owner doesn't match
Invalid	If the path doesn't exist, isn't a directory, or access denied

1.12 Readable

Description

The “readable” verb takes in no parameters and will return true if the directory provided can be read at the Grasshopper privilege level.

Usage

```
directory(<directory path>).readable
```

Example

```
directory("c:\windows").readable
```

The above example checks to see if the “c:\windows” directory is readable by the Grasshopper binary.

Return Values

Return Code	Description
True	If the path exists, is a directory, and is readable
False	If the path exists, is a directory, and is not readable
Invalid	If the path doesn't exist or is not a directory

1.13 Writable

Description

The “writable” verb takes in no parameters and will return true if the directory provided can create files at the Grasshopper privilege level.

Usage

```
directory(<directory path>).writeable
```

Example

```
directory("c:\windows").writeable
```

The above example checks to see if the Grasshopper binary can create files in the “c:\windows” directory.

Return Values

Return Code	Description
True	If the path exists, is a directory, and is writable
False	If the path exists, is a directory, and is not writable
Invalid	If the path doesn't exist or is not a directory

1.14 WritableDirectory

Description

The “writable_dir” verb takes in no parameters and will return true if the directory provided can be create directories at the Grasshopper privilege level.

Usage

```
directory(<directory path>).writable_dir
```

Example

```
directory("c:\windows").writable_dir
```

The above example checks to see if the Grasshopper binary can create directories in the “c:\windows” directory.

Return Values

Return Code	Description
True	If the path exists, is a directory, and is writable
False	If the path exists, is a directory, and is not writable
Invalid	If the path doesn't exist or is not a directory

2 File

Description

The “file” noun takes in a single file path parameter that all of the corresponding verbs are applied against. All supported verbs are related to data and interactions with the target file system files.

Usage

```
file(<file path>).<verb data>
```

Example

```
file("c:\windows\regedit.exe").<verb data>
```

The above example applies the “c:\windows\regedit.exe” file path to the noun, which will then be used in conjunction with whatever verb is applied.

2.1 Accessed After

Description

The “accessed_after” verb takes in a single date parameter and verifies that the provided file was last accessed after the provided date. The date must be in either ISO 9601 format, 2012-01-01T12:00:00 or 2012-01-01.

Usage

```
file(<file path>).accessed_after(<timestamp>)
```

Example

```
file("c:\windows").accessed_after("2012-01-01")
```

The above example verifies that the provided file was accessed after January 1st, 2012 at midnight.

Return Values

Return Code	Description
True	Path exists, is a file, and meets the criteria
False	Path exists, is a file, and doesn't meet the criteria
Invalid	Path does not file or is not a directory

2.2 Accessed Before

Description

The “accessed_before” verb takes in a single date parameter and verifies that the provided file was last accessed before the provided date. The date must be in either ISO 9601 format, 2012-01-01T12:00:00 or 2012-01-01.

Usage

```
file(<file path>).accessed_before(<timestamp>)
```

Example

```
file("c:\windows").accessed_before("2012-01-01")
```

The above example verifies that the provided file was accessed before January 1st, 2012 at midnight.

Return Values

Return Code	Description
True	Path exists, is a file, and meets the criteria
False	Path exists, is a file, and doesn't meet the criteria
Invalid	Path does not exist or is not a file

2.3 Created After

Description

The “created_after” verb takes in a single date parameter and verifies that the provided file was created after the provided date. The date must be in either ISO 9601 format, 2012-01-01T12:00:00 or 2012-01-01.

Usage

```
file(<file path>).created_after(<timestamp>)
```

Example

```
file("c:\windows").created_after("2012-01-01")
```

The above example verifies that the provided file was created after January 1st, 2012 at midnight.

Return Values

Return Code	Description
True	Path exists, is a file, and meets the criteria
False	Path exists, is a file, and doesn't meet the criteria
Invalid	Path does not exist or is not a file

2.4 Created Before

Description

The “created_before” verb takes in a single date parameter and verifies that the provided file was created before the provided date. The date must be in either ISO 9601 format, 2012-01-01T12:00:00 or 2012-01-01.

Usage

```
file(<file path>).created_before(<timestamp>)
```

Example

```
file("c:\windows").created_before("2012-01-01")
```

The above example verifies that the provided file was created before January 1st, 2012 at midnight.

Return Values

Return Code	Description
True	Path exists, is a file, and meets the criteria
False	Path exists, is a file, and doesn't meet the criteria
Invalid	Path does not exist or is not a file

2.5 Exists

Description

The “exists” verb takes in no parameters and will return true if the file path provided exists and is a file

Usage

```
file(<file path>).exists
```

Example

```
file("c:\windows\system32\notepad.exe").exists
```

The above example checks to see if the “c:\windows\system32\notepad.exe” file path exists and is a file.

Return Values

Return Code	Description
True	The path exists and is a file
False	The path doesn't exist
Invalid	Access denied or the path exists but is not a file

2.6 Find String

Description

The “find_string” verb takes in a single string parameter and checks to see whether the provided string exists within the file.

Usage

```
file(<file path>).find_string(<string>)
```

Example

```
file("c:\windows\system32\notepad.exe").find_string("test string")
```

The above example checks to see if the “c:\windows\system32\notepad.exe” file contains the string “test string”.

Return Values

Return Code	Description
True	If the path exists, is a file, and contains the string
False	If the path exists, is a file, and doesn't contain the string
Invalid	If the path doesn't exist, isn't a file, or access denied

2.7 MD5

Description

The “md5” verb takes in a single 32 character md5 sum parameter and checks to see whether the file matches the value.

Usage

```
file(<file path>).md5 (<md5 sum>)
```

Example

```
file("c:\notepad.exe").md5(0123456789abcdefG123456789abcdef)
```

The above example checks to see if the “c:\notepad.exe” file has the provided md5 hash.

Return Values

Return Code	Description
True	If the path exists, is a file, and matches the md5 sum
False	If the path exists, is a file, and doesn't match the md5 sum
Invalid	If the path doesn't exist, isn't a file, or access denied

2.8 Modified After

Description

The “modified_after” verb takes in a single date parameter and verifies that the provided file was modified after the provided date. The date must be in either ISO 9601 format, 2012-01-01T12:00:00 or 2012-01-01.

Usage

```
file(<file path>).modified_after(<timestamp>)
```

Example

```
file("c:\windows").modified_after("2012-01-01")
```

The above example verifies that the provided file was modified after January 1st, 2012 at midnight.

Return Values

Return Code	Description
True	Path exists, is a file, and meets the criteria
False	Path exists, is a file, and doesn't meet the criteria
Invalid	Path does not exist or is not a file

2.9 Modified Before

Description

The “modified_before” verb takes in a single date parameter and verifies that the provided file was modified before the provided date. The date must be in either ISO 9601 format, 2012-01-01T12:00:00 or 2012-01-01.

Usage

```
file(<file path>).modified_before(<timestamp>)
```

Example

```
file("c:\windows").modified_before("2012-01-01")
```

The above example verifies that the provided file was modified before January 1st, 2012 at midnight.

Return Values

Return Code	Description
True	Path exists, is a file, and meets the criteria
False	Path exists, is a file, and doesn't meet the criteria
Invalid	Path does not exist or is not a file

2.10 Owned By

Description

The “owned_by” verb takes in a single parameter describing the user to check for ownership. The fact will return true only if the provided file is owned by the provided user.

Note: doesn't include the DOMAIN.

Usage

```
file(<file path>).owned_by(<user name>)
```

Example

```
file("c:\windows\system32\notepad.exe").owned_by("admin")
```

The above example checks to see if the “c:\windows\system32\notepad.exe” file is owned by the user “admin”.

Return Values

Return Code	Description
True	If the path exists, is a file, and the owner matches
False	If the path exists, is a file, and the owner doesn't match
Invalid	If the path doesn't exist, isn't a file, or access denied

2.11 Readable

Description

The “readable” verb takes in no parameters and will return true if the file provided can be read at the Grasshopper privilege level.

Usage

```
file(<file path>).readable
```

Example

```
file("c:\windows\system32\notepad.exe").readable
```

The above example checks to see if the Grasshopper binary can read the file “c:\windows\system32\notepad.exe”.

Return Values

Return Code	Description
True	If the path exists, is a file, and is readable
False	If the path exists, is a file, and is not readable
Invalid	If the path doesn't exist or is not a file

2.12 Size Greater

Description

The “size_greater” verb takes in a size value and check to see if the file is larger than the provided size. The size value can be numeric or a file size complex number.

Usage

```
file(<file path>).size_greater(<file size>)
```

Example

```
file("c:\windows\system32\notepad.exe").size_greater('5m')
```

The above example checks to see if the file “c:\windows\system32\notepad.exe” is larger than 5 megabytes.

Return Values

Return Code	Description
True	If the path exists, is a file, and is larger than the provided size
False	If the path exists, is a file, and is not larger than the provided size
Invalid	If the path doesn't exist or is not a file

2.13 Size Less

Description

The “size_less” verb takes in a size value and check to see if the file is smaller than the provided size. The size value can be numeric or a file size complex number.

Usage

```
file(<file path>).size_less(<file size>)
```

Example

```
file("c:\windows\system32\notepad.exe").size_less('5m')
```

The above example checks to see if the file “c:\windows\system32\notepad.exe” is smaller than 5 megabytes.

Return Values

Return Code	Description
True	If the path exists, is a file, and is smaller than the provided size
False	If the path exists, is a file, and is not smaller than the provided size
Invalid	If the path doesn't exist or is not a file

2.14 Writable

Description

The “writable” verb takes in no parameters and will return true if the file provided can be modified at the Grasshopper privilege level.

Usage

```
file(<file path>).writable
```

Example

```
file("c:\windows\system32\notepad.exe").writable
```

The above example checks to see if the Grasshopper binary can modify the file “c:\windows\system32\notepad.exe”.

Return Values

Return Code	Description
True	If the path exists, is a file, and is writable
False	If the path exists, is a file, and is not writable
Invalid	If the path doesn't exist or is not a file

3 Grasshopper

Description

The “grasshopper” noun takes no parameters. All supported verbs are specific to the Grasshopper binary execution and do not interact with the target system.

Usage

```
grasshopper.<verb data>
```

Example

```
grasshopper.<verb data>
```

The above example has no parameters and is completely dependent on the verb selection.

3.1 Access At Least

Description

The “access_at_least” verb takes in an access level value and checks to see if the Grasshopper binary is running at least the level provided. Valid access level values are “admin” and “system”

Usage

```
grasshopper.access_at_least(<access level>)
```

Example

```
grasshopper.access_at_least("admin")
```

The above example checks to see if the Grasshopper binary is running as at least administrator.

Return Values

Return Code	Description
True	If the Grasshopper binary is running at the provided level or higher
False	If the Grasshopper binary is running at a lower privilege level than the provided level
Invalid	N/A

3.2 Bitness

Description

The “bitness” verb takes in a bitness value and check to see if the Grasshopper binary is the provided bitness.

Usage

```
grasshopper.bitness(<bitness>)
```

Example

```
grasshopper.bitness(64)
```

The above example checks to see if the Grasshopper binary is 64-bit.

Return Values

Return Code	Description
True	If the Grasshopper binary is the provided bitness
False	If the Grasshopper binary is not the provided bitness
Invalid	N/A

3.3 False

Description

The “false” verb takes in no parameters and always returns false.

Usage

```
grasshopper . false
```

Example

```
grasshopper . false
```

The above example returns false.

Return Values

Return Code	Description
True	N/A
False	Always returns false
Invalid	N/A

3.4 True

Description

The “true” verb takes in no parameters and always returns true.

Usage

```
grasshopper.true
```

Example

```
grasshopper.true
```

The above example returns true.

Return Values

Return Code	Description
True	Always returns true
False	N/A
Invalid	N/A

4 Network

Description

The “network” noun takes no parameters. All supported verbs are related to network communications and status.

Usage

network.<verb data>

Example

network.<verb data>

The above example has no parameters and is completely dependent on the verb selection.

4.1 ConnectTo

Description

The “connect_to” verb takes in either an IP address or a host name and checks to see if it is accessible from the target.

Usage

```
network.connect_to(<host data>)
```

Example

```
network.connect_to(10.10.10.10)
```

The above example attempts a connection to the IP address “10.10.10.10”.

Return Values

Return Code	Description
True	If the connection to the provided host is successful
False	If the connection to the provided host is not successful
Invalid	If there was an error setting up the connection

4.2 DNSLookup

Description

The “dns_lookup” verb takes in either an IP address or a host name and checks to see if it the DNS data can be accessed.

Usage

```
network.dns_lookup(<host data>)
```

Example

```
network.dns_lookup("google.com")
```

The above example attempts a DNS lookup on the host “google.com”

Return Values

Return Code	Description
True	If the DNS lookup for the provided host is successful
False	If the DNS lookup for the provided host is not successful
Invalid	If an error occurred while attempting the DNS lookup

4.3 HasProxy

Description

The “has_proxy” verb takes in no parameters and checks to see if a proxy is configured on the target.

Usage

```
network.has_proxy
```

Example

```
network.has_proxy
```

The above example checks to see if there is a proxy on the target device.

Return Values

Return Code	Description
True	If the target has a proxy configured
False	If the target has no proxy
Invalid	If an error occurs while checking for the proxy

4.4 PortAvailable

Description

The “port_available” verb takes in a port value and checks to see if the port is currently being used on the target.

Usage

```
network.port_available(<port value>)
```

Example

```
network.port_available(4332)
```

The above example checks to see if the port “4332” is being used on the target.

Return Values

Return Code	Description
True	If the provided port is not currently in use
False	If the provided port is currently in use
Invalid	If there was a problem getting the port table

4.5 ProcessListening

Description

The “process_listening” verb takes in a process name and checks to see if the process is listening on any ports.

Usage

```
network.process_listening(<process name>)
```

Example

```
network.process_listening("apache.exe")
```

The above example checks to see if the process “apache.exe” is listening on any ports.

Return Values

Return Code	Description
True	If the provided process is listening on one or more ports
False	If the provided process is not listening on any ports
Invalid	If the provided process is not running on the target system

4.6 ProcessListeningOn

Description

The “process_listening_on” verb takes in a process name and a port, and checks to see if the process is listening on the provided port.

Usage

```
network.process_listening_on(<process name>, <port value>)
```

Example

```
network.process_listening("apache.exe", 80)
```

The above example checks to see if the process “apache.exe” is listening on port “80”.

Return Values

Return Code	Description
True	If the provided process is listening on the provided port
False	If the provided process is not listening on the provided port
Invalid	If the provided process is not running on the target system

5 OS

Description

The “os” noun takes no parameters. All supported verbs are related to the target operating system information.

Usage

os.<verb data>

Example

os.<verb data>

The above example has no parameters and is completely dependent on the verb selection.

5.1 Activated

Description

The “activated” verb takes in no parameters and checks to see if the Windows installation is activated with Microsoft.

Usage

```
os.activated
```

Example

```
os.activated
```

The above example checks to see if target has an activated Windows installation.

Return Values

Return Code	Description
True	If the target has an activated Windows installation
False	If the target Windows installation has not been activated
Invalid	If an error occurred while getting OS information

5.2 At Least

Description

The “at_least” verb takes in a windows version string value and checks to see if the target Windows installation is that version or higher. The valid Windows version strings are shown in the table below:

winxp-sp0	winxp-sp1	winxp-sp2
winxp-sp3	winxppro-sp0	winxppro-sp1
winxppro-sp2	winxppro-sp3	win2003-sp0
win2003-sp1	win2003-sp2	win2003-sp3
vista-sp0	vista-sp1	vista-sp2
win2008-sp0	win2008-sp1	win2008-sp2
win2008r2-sp0	win2008r2-sp1	win7-sp0
win7-sp1	win8-sp0	

Usage

```
os.at_least(<windows version>)
```

Example

```
os.at_least("winxp-sp3")
```

The above example checks to see if target Windows installation has a version that is the same or greater than “winxp-sp3”.

Return Values

Return Code	Description
True	If the target Windows installation is equal to or greater than the provided version
False	If the target Windows installation is less than the provided version
Invalid	If an error occurred while getting OS information

5.3 Bitness

Description

The “bitness” verb takes in a bitness value and checks to see if the target Windows installation matches the provided bitness.

Usage

```
os.bitness(<bitness value>)
```

Example

```
os.bitness(32)
```

The above example checks to see if target Windows installation is 32-bit.

Return Values

Return Code	Description
True	If the target Windows installation matches the provided bitness
False	If the target Windows installation doesn't match the provided bitness
Invalid	If an error occurred while getting OS information

5.4 Family

Description

The “family” verb takes in a windows family string value and checks to see if the target Windows installation is within that family. The valid Windows family strings are shown in the table below:

winxp	winxpro	win2003
vista	win2008	win2008r2
win7	win8	

Usage

```
os.family(<windows family>)
```

Example

```
os.family("winxp")
```

The above example checks to see if target Windows installation is within the “winxp” family.

Return Values

Return Code	Description
True	If the target Windows installation is within the provided Windows family
False	If the target Windows installation is not within the provided Windows family
Invalid	If an error occurred while getting OS information

5.5 Older Than

Description

The “older_than” verb takes in a windows version string value and checks to see if the target Windows installation is older than the provided value. The valid Windows version strings are shown in the table below:

winxp-sp0	winxp-sp1	winxp-sp2
winxp-sp3	winxpro-sp0	winxpro-sp1
winxpro-sp2	winxpro-sp3	win2003-sp0
win2003-sp1	win2003-sp2	win2003-sp3
vista-sp0	vista-sp1	vista-sp2
win2008-sp0	win2008-sp1	win2008-sp2
win2008r2-sp0	win2008r2-sp1	win7-sp0
win7-sp1	win8-sp0	

Usage

```
os.older_than(<windows version>)
```

Example

```
os.older_than("winxp-sp3")
```

The above example checks to see if target Windows installation has a version that older than “winxp-sp3”.

Return Values

Return Code	Description
True	If the target Windows installation is older than the provided version
False	If the target Windows installation is equal to or greater than the provided version
Invalid	If an error occurred while getting OS information

5.6 Patch Applied

Description

The “`patch_applied`” verb takes in a patch string and check the target Windows installation to see if the patch has been installed.

Usage

```
os.patch_applied(<patch string>)
```

Example

```
os.older_than("abcd")
```

The above example checks to see if target Windows installation has the “abcd” patch installed.

Return Values

Return Code	Description
True	If the target Windows installation has the provided patch installed
False	If the target Windows installation does not have the provided patch installed
Invalid	If an error occurred while getting patch information

5.7 Release

Description

The “release” verb takes in a windows version string value and checks to see if the target Windows installation is the provided release version. The valid Windows version strings are shown in the table below:

winxp-sp0	winxp-sp1	winxp-sp2
winxp-sp3	winxpro-sp0	winxpro-sp1
winxpro-sp2	winxpro-sp3	win2003-sp0
win2003-sp1	win2003-sp2	win2003-sp3
vista-sp0	vista-sp1	vista-sp2
win2008-sp0	win2008-sp1	win2008-sp2
win2008r2-sp0	win2008r2-sp1	win7-sp0
win7-sp1	win8-sp0	

Usage

```
os.release(<windows version>)
```

Example

```
os.release("winxp-sp3")
```

The above example checks to see if target Windows installation is release version “winxp-sp3”.

Return Values

Return Code	Description
True	If the target Windows installation is the provided version
False	If the target Windows installation is not the provided version
Invalid	If an error occurred while getting OS information

6 Process

Description

The “process” noun takes a process name parameter that all of the corresponding verbs are applied against. All supported verbs are related to target system process status and metadata.

Usage

```
process(<process name|*>).<verb data>
```

Example

```
process(wireshark.exe).exists  
process(*).has_loaded(wireshark.dll)
```

The above examples show process with both a specific process and the special “*” process.

6.1 Exists

Description

The “exists” verb takes in no parameters and will return true if the processexists.

Usage

```
process(<process name>).exists
```

Example

```
process(“explore.exe”).exists
```

The above example checks to see if the “explore.exe” process exists.

Return Values

Return Code	Description
True	If the process exists
False	If the process doesn't exist
Invalid	If an error occurred while getting the process information

6.2 OwnedBy

Description

The “owned_by” verb takes in no parameters and will return true if the process is owned by the provided user.

Usage

```
process(<process name>).owned_by(<user name>)
```

Example

```
process("explore.exe").owned_by("admin")
```

The above example checks to see if the “explore.exe” process is owned by the user “admin”.

Return Values

Return Code	Description
True	If the process exists and is owned by the provided user
False	If the process exists and is not owned by the provided user
Invalid	If the process doesn't exist or an error occurs while getting the process information

6.3 HasLoaded

Description

The “has_loaded” verb works with either a named process (ie, wireshark.exe) or with *, meaning any process on the system. It takes a comma-separated list of DLLs to look for. HasLoaded returns True if all of those DLLs are present in a given set of processes.

Usage

```
process(<process name>|*).has_loaded(<dll_1>,<dll_2>,...)
```

Example

```
process(kasperksy.exe).has_loaded(some_dll.dll,some_other_dll.dll)
```

The above example checks to see if the “kasperksy.exe” process has both some_dll.dll and some_other_dll.dll loaded

```
process(*).has_loaded(wireshark_signature.dll)
```

The above example checks every process to see if any has wireshark_signature.dll loaded.

Return Values

Return Code	Description
True	A process exists and has the given DLLs loaded
False	No such process exists
Invalid	A process exists, but none has the given DLLs loaded, and at least one of the processes could not be examined (likely due to permissions)

6.4 HasExactlyLoaded

Description

The “has_exactly_loaded” verb works with either a named process (ie, wireshark.exe) or with *, meaning any process on the system. It takes a comma-separated list of DLLs to look for. HasLoaded returns True if all of those (*and **only** those*) **DLLs** are present in a given set of processes.

Note that this fact is very sensitive and will likely only make sense in very restricted circumstances. There are many reasons a process may slightly change it’s set of loaded DLLs during execution. Consider using has_loaded unless substantial testing has been done.

Usage

```
process(<process name>|* ).has_exactly_loaded(<dll_1>,<dll_2>,...)
```

Example

```
process(kasperksy.exe).has_exactly_loaded(some_dll.dll,some_other_dll.dll)
```

The above example checks to see if the “kasperksy.exe” process has both some_dll.dll and some_other_dll.dll loaded, and no other DLLs.

Return Values

Return Code	Description
True	A process exists and has exactly the given DLLs loaded
False	No such process exists
Invalid	A process exists, but none have the given DLLs loaded, and at least one of the processes could not be examined (likely due to permissions)

6.5 Reg Key

Description

The “reg_key” noun takes hive name and key path parameters that all of the corresponding verbs are applied against. All supported verbs are related to target system registry keys.

Usage

```
reg_key(<hive name>, <key path>).<verb data>
```

Example

```
reg_key(HKLM, “test”)
```

The above example applies the hive name “HKLM” and key path “test” to the noun, which will then be used in conjunction with whatever verb is applied.

6.6 Contains

Description

The “contains” verb takes in one parameter and checks to see if the provided key name is within the key path.

Usage

```
reg_key(<hive name>, <key path>).contains(<key name>)
```

Example

```
reg_key(HKLM, “test”).contains(“test_key”)
```

The above example checks to see if the “test_key” key is within the provided key path.

Return Values

Return Code	Description
True	If the key is in the provided path
False	If the key isn't in the provided path
Invalid	If an error occurred while accessing the key

6.7 Exists

Description

The “exists” verb takes in one parameter and checks to see if the provided key exists on the target.

Usage

```
reg_key(<hive name>, <key path>).exists
```

Example

```
reg_key(HKLM, “test”).exists
```

The above example checks to see if the “test” key exists on the target.

Return Values

Return Code	Description
True	If the key exists on the target
False	If the key doesn't exist on the target
Invalid	If an error occurred while accessing the key

7 Reg Value

Description

The “reg_value” noun takes hive name, key path, and key value parameters that all of the corresponding verbs are applied against. All supported verbs are related to target system registry key values.

Usage

```
reg_value(<hive name>, <key path>, <value name>).<verb data>
```

Example

```
reg_value(HKLM, “test”, “test_value”).<verb data>
```

The above example applies the hive name “HKLM”, key path “test”, and the key value “test_value” to the noun, which will then be used in conjunction with whatever verb is applied.

7.1 Exists

Description

The “exists” verb takes in one parameter and checks to see if the provided keyexists on the target.

Usage

```
reg_value(<hive name>, <key path>, <value name>).exists
```

Example

```
reg_value(HKLM, “test”, “test_value”).exists
```

The above example checks to see if the “test_value” value exists within the provided key.

Return Values

Return Code	Description
True	If the value exists
False	If the value doesn't exist
Invalid	If an error occurred while accessing the value

7.2 Find String

Description

The “`find_string`” verb takes in one parameter and checks to see if the value contains the provided string.

Usage

```
reg_value(<hive name>, <key path>, <value name>).find_string(<string>)
```

Example

```
reg_value(HKLM, "test", "test_value").find_string("test")
```

The above example checks to see if the string “test” exists within the provided value

Return Values

Return Code	Description
True	If the string exists within the provided value
False	If the string doesn't exist within the provided value
Invalid	If an error occurred while accessing the value

7.3 Matches Numeric

Description

The “`matches_numeric`” verb takes in one parameter and checks to see if the value is the provided number

Usage

```
reg_value(<hive name>, <key path>, <value name>).matches_numeric(<number>)
```

Example

```
reg_value(HKLM, "test", "test_value").matches_numeric(0x5a)
```

The above example checks to see if the value is set to “0x5a”.

Return Values

Return Code	Description
True	If the value matches the provided number
False	If the value doesn't match the provided number
Invalid	If an error occurred while accessing the value

7.4 Matches String

Description

The “`matches_string`” verb takes in one parameter and checks to see if the value is the provided number

Usage

```
reg_value(<hive name>, <key path>, <value name>).matches_string(<string>)
```

Example

```
reg_value(HKLM, "test", "test_value").matches_string("test")
```

The above example checks to see if the value is set to “test”.

Return Values

Return Code	Description
True	If the value matches the provided string
False	If the value doesn't match the provided string
Invalid	If an error occurred while accessing the value

7.5 Type

Description

The “type” verb takes in a registry type value and checks to see if the registry value is the provided type. The valid registry type value strings are shown in the table below:

REG_NONE	REG_SZ	REG_QWORD_LITTLE_ENDIAN
REG_BINARY	REG_DWORD	REG_DWORD_LITTLE_ENDIAN
REG_MULTI_SZ	REG_LINE	REG_DWORD_BIG_ENDIAN
REG_QWORD	REG_EXPAND_SZ	REG_MULTI_SZ_UPDATE
REG_KEY		

Usage

```
reg_value(<hive name>, <key path>, <value name>).type(<registry_type>)
```

Example

```
reg_value(HKLM, "test", "test_value").type(REG_BINARY)
```

The above example checks to see if the registry value is of type “REG_BINARY”.

Return Values

Return Code	Description
True	If the registry value is the provided type
False	If the registry value isn't the provided type
Invalid	If an error occurred while accessing the value

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