Red Hat Enterprise Linux 5
SystemTap Tapset Reference

For SystemTap in Red Hat Enterprise Linux 5
Edition 1

Red Hat Enterprise Linux Documentation

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Abstract

The Tapset Reference Guide describes the most common tapset definitions users can apply to SystemTap scripts. All included tapsets documented in this guide are current as of the latest upstream version of SystemTap.

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Preface

Chapter 1. Introduction

SystemTap provides free software (GPL) infrastructure to simplify the gathering of information about the running Linux system. This assists diagnosis of a performance or functional problem. SystemTap eliminates the need for the developer to go through the tedious and disruptive instrument, recompile, install, and reboot sequence that may be otherwise required to collect data.

SystemTap provides a simple command line interface and scripting language for writing instrumentation for a live, running kernel. This instrumentation uses probe points and functions provided in the *tapset* library.

Simply put, tapsets are scripts that encapsulate knowledge about a kernel subsystem into pre-written probes and functions that can be used by other scripts. Tapsets are analogous to libraries for C programs. They hide the underlying details of a kernel area while exposing the key information needed to manage and monitor that aspect of the kernel. They are typically developed by kernel subject-matter experts.

A tapset exposes the high-level data and state transitions of a subsystem. For the most part, good tapset developers assume that SystemTap users know little to nothing about the kernel subsystem's low-level details. As such, tapset developers write tapsets that help ordinary SystemTap users write meaningful and useful SystemTap scripts.

1.1. Documentation Goals

This guide aims to document SystemTap's most useful and common tapset entries; it also contains guidelines on proper tapset development and documentation. The tapset definitions contained in this guide are extracted automatically from properly-formatted comments in the code of each tapset file. As such, any revisions to the definitions in this guide should be applied directly to their respective tapset file.

Chapter 2. Tapset Development Guidelines

This chapter describes the upstream guidelines on proper tapset documentation. It also contains information on how to properly document your tapsets, to ensure that they are properly defined in this guide.

2.1. Writing Good Tapsets

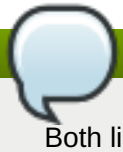
The first step to writing good tapsets is to create a simple model of your subject area. For example, a model of the process subsystem might include the following:

Key Data

- process ID
- parent process ID
- process group ID

State Transitions

- forked
- exec'd
- running
- stopped
- terminated



Note

Both lists are examples, and are not meant to represent a complete list.

Use your subsystem expertise to find probe points (function entries and exits) that expose the elements of the model, then define probe aliases for those points. Be aware that some state transitions can occur in more than one place. In those cases, an alias can place a probe in multiple locations.

For example, process execs can occur in either the **`do_execve()`** or the **`compat_do_execve()`** functions. The following alias inserts probes at the beginning of those functions:

```
probe kprocess.exec = kernel.function("do_execve"),
kernel.function("compat_do_execve")
{probe body}
```

Try to place probes on stable interfaces (i.e., functions that are unlikely to change at the interface level) whenever possible. This will make the tapset less likely to break due to kernel changes. Where kernel version or architecture dependencies are unavoidable, use preprocessor conditionals (see the **`stap(1)`** man page for details).

Fill in the probe bodies with the key data available at the probe points. Function entry probes can access the entry parameters specified to the function, while exit probes can access the entry parameters and the return value. Convert the data into meaningful forms where appropriate (e.g., bytes to kilobytes, state values to strings, etc).

You may need to use auxiliary functions to access or convert some of the data. Auxiliary functions often use embedded C to do things that cannot be done in the SystemTap language, like access structure fields in some contexts, follow linked lists, etc. You can use auxiliary functions defined in other tapsets or write your own.

In the following example, **`copy_process()`** returns a pointer to the **`task_struct`** for the new process. Note that the process ID of the new process is retrieved by calling **`task_pid()`** and passing it the **`task_struct`** pointer. In this case, the auxiliary function is an embedded C function defined in **`task.stp`**.

```
probe kprocess.create = kernel.function("copy_process").return
{
   task = $return
   new_pid = task_pid(task)
}
```

It is not advisable to write probes for every function. Most SystemTap users will not need or understand them. Keep your tapsets simple and high-level.

2.2. Elements of a Tapset

The following sections describe the most important aspects of writing a tapset. Most of the content herein is suitable for developers who wish to contribute to SystemTap's upstream library of tapsets.

2.2.1. Tapset Files

Tapset files are stored in ***`src`*`/tapset/`** of the SystemTap GIT directory. Most tapset files are kept at that level. If you have code that only works with a specific architecture or kernel version, you may choose to put your tapset in the appropriate subdirectory.

Installed tapsets are located in **`/usr/share/systemtap/tapset/`** or **`/usr/local/share/systemtap/tapset`**.

Personal tapsets can be stored anywhere. However, to ensure that SystemTap can use them, use **`-I`** ***`tapset_directory`*** to specify their location when invoking **`stap`**.

2.2.2. Namespace

Probe alias names should take the form ***`tapset_name.probe_name`***. For example, the probe for sending a signal could be named **`signal.send`**.

Global symbol names (probes, functions, and variables) should be unique accross all tapsets. This helps avoid namespace collisions in scripts that use multiple tapsets. To ensure this, use tapset-specific prefixes in your global symbols.

Internal symbol names should be prefixed with an underscore (_).

2.2.3. Comments and Documentation

All probes and functions should include comment blocks that describe their purpose, the data they provide, and the context in which they run (e.g. interrupt, process, etc). Use comments in areas where your intent may not be clear from reading the code.

Note that specially-formatted comments are automatically extracted from most tapsets and included in this guide. This helps ensure that tapset contributors can write their tapset *and* document it in the same place. The specified format for documenting tapsets is as follows:

```
/**
 * probe tapset.name - Short summary of what the tapset does.
 * @argument: Explanation of argument.
 * @argument2: Explanation of argument2. Probes can have multiple arguments.
 *
 * Context:
 * A brief explanation of the tapset context.
 * Note that the context should only be 1 paragraph short.
 *
 * Text that will appear under "Description."
 *
 * A new paragraph that will also appear under the heading "Description".
 *
 * Header:
 * A paragraph that will appear under the heading "Header".
 **/
```

For example:

```
/**
 * probe vm.write_shared_copy- Page copy for shared page write.
 * @address: The address of the shared write.
 * @zero: Boolean indicating whether it is a zero page
 *         (can do a clear instead of a copy).
 *
 * Context:
 *  The process attempting the write.
 *
 *  Fires when a write to a shared page requires a page copy.  This is
 *  always preceded by a vm.shared_write.
 **/
```

To override the automatically-generated **Synopsis** content, use:

```
 * Synopsis:
 * New Synopsis string
 *
```

For example:

```
/**
 * probe signal.handle - Fires when the signal handler is invoked
 * @sig: The signal number that invoked the signal handler
 *
 * Synopsis:
 * <programlisting>static int handle_signal(unsigned long sig, siginfo_t
*info, struct k_sigaction *ka,
 * sigset_t *oldset, struct pt_regs * regs)</programlisting>
 */
```

It is recommended that you use the **<programlisting>** tag in this instance, since overriding the **Synopsis** content of an entry does not automatically form the necessary tags.

For the purposes of improving the DocBook XML output of your comments, you can also use the following XML tags in your comments:

- **command**
- **emphasis**
- **programlisting**
- **remark** (tagged strings will appear in Publican beta builds of the document)

Chapter 3. Context Functions

The context functions provide additional information about where an event occurred. These functions can provide information such as a backtrace to where the event occured and the current register values for the processor.

Name

print_regs — Print a register dump.

Synopsis

```
function print_regs()
```

Arguments

None

Name

execname — Returns the execname of a target process (or group of processes).

Synopsis

```
function execname:string()
```

Arguments

None

Name

pid — Returns the ID of a target process.

Synopsis

```
function pid:long()
```

Arguments

None

Name

tid — Returns the thread ID of a target process.

Synopsis

```
function tid:long()
```

Arguments

None

Name

ppid — Returns the process ID of a target process's parent process.

Synopsis

```
function ppid:long()
```

Arguments

None

Name

pgrp — Returns the process group ID of the current process.

Synopsis

```
function pgrp:long()
```

Arguments

None

Name

sid — Returns the session ID of the current process.

Synopsis

```
function sid:long()
```

Arguments

None

Description

The session ID of a process is the process group ID of the session leader. Session ID is stored in the signal_struct since Kernel 2.6.0.

Name

pexecname — Returns the execname of a target process's parent process.

Synopsis

```
function pexecname:string()
```

Arguments

None

Name

gid — Returns the group ID of a target process.

Synopsis

```
function gid:long()
```

Arguments

None

Name

egid — Returns the effective gid of a target process.

Synopsis

```
function egid:long()
```

Arguments

None

Name

uid — Returns the user ID of a target process.

Synopsis

```
function uid:long()
```

Arguments

None

Name

euid — Return the effective uid of a target process.

Synopsis

```
function euid:long()
```

Arguments

None

Name

cpu — Returns the current cpu number.

Synopsis

```
function cpu:long()
```

Arguments

None

Name

pp — Return the probe point associated with the currently running probe handler,

Synopsis

```
function pp:string()
```

Arguments

None

Description

including alias and wildcard expansion effects

Context

The current probe point.

Name

registers_valid — Determines validity of **`register`** and **`u_register`** in current context.

Synopsis

```
function registers_valid:long()
```

Arguments

None

Description

Return 1 if **`register`** and **`u_register`** can be used in the current context, or 0 otherwise. For example, **`registers_valid`** returns 0 when called from a begin or end probe.

Name

user_mode — Determines if probe point occurs in user-mode.

Synopsis

```
function user_mode:long()
```

Arguments

None

Description

Return 1 if the probe point occurred in user-mode.

Name

is_return — Determines if probe point is a return probe.

Synopsis

```
function is_return:long()
```

Arguments

None

Description

Return 1 if the probe point is a return probe. *Deprecated.*

Name

target — Return the process ID of the target process.

Synopsis

```
function target:long()
```

Arguments

None

Name

stack_size — Return the size of the kernel stack.

Synopsis

```
function stack_size:long()
```

Arguments

None

Name

stack_used — Returns the amount of kernel stack used.

Synopsis

```
function stack_used:long()
```

Arguments

None

Description

Determines how many bytes are currently used in the kernel stack.

Name

stack_unused — Returns the amount of kernel stack currently available.

Synopsis

```
function stack_unused:long()
```

Arguments

None

Description

Determines how many bytes are currently available in the kernel stack.

Name

uaddr — User space address of current running task. EXPERIMENTAL.

Synopsis

```
function uaddr:long()
```

Arguments

None

Description

Returns the address in userspace that the current task was at when the probe occured. When the current running task isn't a user space thread, or the address cannot be found, zero is returned. Can be used to see where the current task is combined with **usymname** or **symdata**. Often the task will be in the VDSO where it entered the kernel. FIXME - need VDSO tracking support #10080.

Name

print_stack — Print out stack from string.

Synopsis

```
function print_stack(stk:string)
```

Arguments

stk

String with list of hexidecimal addresses.

Description

Perform a symbolic lookup of the addresses in the given string, which is assumed to be the result of a prior call to **backtrace**.

Print one line per address, including the address, the name of the function containing the address, and an estimate of its position within that function. Return nothing.

Name

probefunc — Return the probe point's function name, if known.

Synopsis

```
function probefunc:string()
```

Arguments

None

Name

probemod — Return the probe point's module name, if known.

Synopsis

```
function probemod:string()
```

Arguments

None

Name

modname — Return the kernel module name loaded at the address.

Synopsis

```
function modname:string(addr:long)
```

Arguments

addr

The address.

Description

Returns the module name associated with the given address if known. If not known it will return the string “<unknown>”. If the address was not in a kernel module, but in the kernel itself, then the string “kernel” will be returned.

Name

symname — Return the symbol associated with the given address.

Synopsis

```
function symname:string(addr:long)
```

Arguments

addr

The address to translate.

Description

Returns the (function) symbol name associated with the given address if known. If not known it will return the hex string representation of addr.

Name

symdata — Return the symbol and module offset for the address.

Synopsis

```
function symdata:string(addr:long)
```

Arguments

addr

The address to translate.

Description

Returns the (function) symbol name associated with the given address if known, plus the module name (between brackets) and the offset inside the module, plus the size of the symbol function. If any element is not known it will be ommitted and if the symbol name is unknown it will return the hex string for the given address.

Name

usymname — Return the symbol of an address in the current task. EXPERIMENTAL!

Synopsis

```
function usymname:string(addr:long)
```

Arguments

addr

The address to translate.

Description

Returns the (function) symbol name associated with the given address if known. If not known it will return the hex string representation of addr.

Name

usymdata — Return the symbol and module offset of an address. EXPERIMENTAL!

Synopsis

```
function usymdata:string(addr:long)
```

Arguments

addr

The address to translate.

Description

Returns the (function) symbol name associated with the given address in the current task if known, plus the module name (between brackets) and the offset inside the module (shared library), plus the size of the symbol function. If any element is not known it will be ommitted and if the symbol name is unknown it will return the hex string for the given address.

Name

print_ustack — Print out stack for the current task from string. EXPERIMENTAL!

Synopsis

```
function print_ustack(stk:string)
```

Arguments

stk

String with list of hexidecimal addresses for the current task.

Description

Perform a symbolic lookup of the addresses in the given string, which is assumed to be the result of a prior call to **ubacktrace** for the current task.

Print one line per address, including the address, the name of the function containing the address, and an estimate of its position within that function. Return nothing.

Name

print_backtrace — Print stack back trace

Synopsis

```
function print_backtrace()
```

Arguments

None

Description

Equivalent to **print_stack(backtrace)**, except that deeper stack nesting may be supported. Return nothing.

Name

backtrace — Hex backtrace of current stack

Synopsis

```
function backtrace:string()
```

Arguments

None

Description

Return a string of hex addresses that are a backtrace of the stack. Output may be truncated as per maximum string length.

Name

caller — Return name and address of calling function

Synopsis

```
function caller:string()
```

Arguments

None

Description

Return the address and name of the calling function.

This is equivalent to calling

sprintf("**s** 0x**x**", symname(**caller_addr**, **caller_addr**)) *Works only for return probes at this time.*

Name

caller_addr — Return caller address

Synopsis

```
function caller_addr:long()
```

Arguments

None

Description

Return the address of the calling function. *Works only for return probes at this time.*

Name

print_ubacktrace — Print stack back trace for current task. EXPERIMENTAL!

Synopsis

```
function print_ubacktrace()
```

Arguments

None

Description

Equivalent to **`print_ustack(ubacktrace)`**, except that deeper stack nesting may be supported. Return nothing.

Name

ubacktrace — Hex backtrace of current task stack. EXPERIMENTAL!

Synopsis

```
function ubacktrace:string()
```

Arguments

None

Description

Return a string of hex addresses that are a backtrace of the stack of the current task. Output may be truncated as per maximum string length. Returns empty string when current probe point cannot determine user backtrace.

Chapter 4. Timestamp Functions

Each timestamp function returns a value to indicate when a function is executed. These returned values can then be used to indicate when an event occurred, provide an ordering for events, or compute the amount of time elapsed between two time stamps.

Name

get_cycles — Processor cycle count.

Synopsis

```
function get_cycles:long()
```

Arguments

None

Description

Return the processor cycle counter value, or 0 if unavailable.

Chapter 5. Memory Tapset

This family of probe points is used to probe memory-related events. It contains the following probe points:

Name

vm_fault_contains — Test return value for page fault reason

Synopsis

```
function vm_fault_contains:long(value:long,test:long)
```

Arguments

value

The fault_type returned by vm.page_fault.return

test

The type of fault to test for (VM_FAULT_OOM or similar)

Name

vm.pagefault — Records that a page fault occurred.

Synopsis

```
vm.pagefault
```

Values

write_access

Indicates whether this was a write or read access; **1** indicates a write, while **0** indicates a read.

address

The address of the faulting memory access; i.e. the address that caused the page fault.

Context

The process which triggered the fault

Name

vm.pagefault.return — Indicates what type of fault occurred.

Synopsis

```
vm.pagefault.return
```

Values

fault_type

Returns either **0** (VM_FAULT_OOM) for out of memory faults, **2** (VM_FAULT_MINOR) for minor faults, **3** (VM_FAULT_MAJOR) for major faults, or **1** (VM_FAULT_SIGBUS) if the fault was neither OOM, minor fault, nor major fault.

Name

addr_to_node — Returns which node a given address belongs to within a NUMA system.

Synopsis

```
function addr_to_node:long(addr:long)
```

Arguments

addr

The address of the faulting memory access.

Name

vm.write_shared — Attempts at writing to a shared page.

Synopsis

```
vm.write_shared
```

Values

address

The address of the shared write.

Context

The context is the process attempting the write.

Description

Fires when a process attempts to write to a shared page. If a copy is necessary, this will be followed by a **vm.write_shared_copy**.

Name

vm.write_shared_copy — Page copy for shared page write.

Synopsis

```
vm.write_shared_copy
```

Values

zero

Boolean indicating whether it is a zero page (can do a clear instead of a copy).

address

The address of the shared write.

Context

The process attempting the write.

Description

Fires when a write to a shared page requires a page copy. This is always preceded by a **vm.shared_write**.

Name

vm.mmap — Fires when an **mmap** is requested.

Synopsis

```
vm.mmap
```

Values

length

The length of the memory segment

address

The requested address

Context

The process calling **mmap**.

Name

vm.munmap — Fires when an **munmap** is requested.

Synopsis

```
vm.munmap
```

Values

length

The length of the memory segment

address

The requested address

Context

The process calling **munmap**.

Name

vm.brk — Fires when a **brk** is requested (i.e. the heap will be resized).

Synopsis

```
vm.brk
```

Values

length

The length of the memory segment

address

The requested address

Context

The process calling **brk**.

Name

vm.oom_kill — Fires when a thread is selected for termination by the OOM killer.

Synopsis

```
vm.oom_kill
```

Values

task

The task being killed

Context

The process that tried to consume excessive memory, and thus triggered the OOM.

Chapter 6. IO Scheduler Tapset

This family of probe points is used to probe IO scheduler activities. It contains the following probe points:

Name

ioscheduler.elv_next_request — Fires when a request is retrieved from the request queue

Synopsis

```
ioscheduler.elv_next_request
```

Values

elevator_name

The type of I/O elevator currently enabled

Name

ioscheduler.elv_next_request.return — Fires when a request retrieval issues a return signal

Synopsis

```
ioscheduler.elv_next_request.return
```

Values

req_flags

Request flags

req

Address of the request

disk_major

Disk major number of the request

disk_minor

Disk minor number of the request

Name

ioscheduler.elv_add_request — A request was added to the request queue

Synopsis

```
ioscheduler.elv_add_request
```

Values

req_flags

Request flags

req

Address of the request

disk_major

Disk major number of the request

elevator_name

The type of I/O elevator currently enabled

disk_minor

Disk minor number of the request

Name

ioscheduler.elv_completed_request — Fires when a request is completed

Synopsis

```
ioscheduler.elv_completed_request
```

Values

req_flags

Request flags

req

Address of the request

disk_major

Disk major number of the request

elevator_name

The type of I/O elevator currently enabled

disk_minor

Disk minor number of the request

Chapter 7. SCSI Tapset

This family of probe points is used to probe SCSI activities. It contains the following probe points:

Name

scsi.ioentry — Prepares a SCSI mid-layer request

Synopsis

```
scsi.ioentry
```

Values

disk_major

The major number of the disk (-1 if no information)

device_state

The current state of the device.

disk_minor

The minor number of the disk (-1 if no information)

Name

scsi.iodispatching — SCSI mid-layer dispatched low-level SCSI command

Synopsis

```
scsi.iodispatching
```

Values

lun

The lun number

req_bufflen

The request buffer length

host_no

The host number

device_state

The current state of the device.

dev_id

The scsi device id

channel

The channel number

data_direction

The data_direction specifies whether this command is from/to the device. 0 (DMA_BIDIRECTIONAL), 1 (DMA_TO_DEVICE), 2 (DMA_FROM_DEVICE), 3 (DMA_NONE)

request_buffer

The request buffer address

Name

scsi.iodone — SCSI command completed by low level driver and enqueued into the done queue.

Synopsis

```
scsi.iodone
```

Values

lun

The lun number

host_no

The host number

device_state

The current state of the device

dev_id

The scsi device id

channel

The channel number

data_direction

The data_direction specifies whether this command is from/to the device.

Name

Name

scsi.iocompleted — SCSI mid-layer running the completion processing for block device I/O requests

Synopsis

```
scsi.iocompleted
```

Values

lun

The lun number

host_no

The host number

device_state

The current state of the device

dev_id

The scsi device id

channel

The channel number

data_direction

The data_direction specifies whether this command is from/to the device

goodbytes

The bytes completed.

Chapter 8. Networking Tapset

This family of probe points is used to probe the activities of the network device and protocol layers.

Name

netdev.receive — Data recieved from network device.

Synopsis

```
netdev.receive
```

Values

protocol

Protocol of recieved packet.

dev_name

The name of the device. e.g: eth0, ath1.

length

The length of the receiving buffer.

Name

netdev.transmit — Network device transmitting buffer

Synopsis

```
netdev.transmit
```

Values

protocol

The protocol of this packet.

dev_name

The name of the device. e.g: eth0, ath1.

length

The length of the transmit buffer.

truesize

The size of the the data to be transmitted.

Name

tcp.sendmsg — Sending a tcp message

Synopsis

```
tcp.sendmsg
```

Values

name

Name of this probe

size

Number of bytes to send

sock

Network socket

Context

The process which sends a tcp message

Name

tcp.sendmsg.return — Sending TCP message is done

Synopsis

```
tcp.sendmsg.return
```

Values

name

Name of this probe

size

Number of bytes sent or error code if an error occurred.

Context

The process which sends a tcp message

Name

tcp.recvmsg — Receiving TCP message

Synopsis

```
tcp.recvmsg
```

Values

saddr

A string representing the source IP address

daddr

A string representing the destination IP address

name

Name of this probe

sport

TCP source port

dport

TCP destination port

size

Number of bytes to be received

sock

Network socket

Context

The process which receives a tcp message

Name

tcp.recvmsg.return — Receiving TCP message complete

Synopsis

```
tcp.recvmsg.return
```

Values

saddr

A string representing the source IP address

daddr

A string representing the destination IP address

name

Name of this probe

sport

TCP source port

dport

TCP destination port

size

Number of bytes received or error code if an error occurred.

Context

The process which receives a tcp message

Name

tcp.disconnect — TCP socket disconnection

Synopsis

```
tcp.disconnect
```

Values

saddr

A string representing the source IP address

daddr

A string representing the destination IP address

flags

TCP flags (e.g. FIN, etc)

name

Name of this probe

sport

TCP source port

dport

TCP destination port

sock

Network socket

Context

The process which disconnects tcp

Name

tcp.disconnect.return — TCP socket disconnection complete

Synopsis

```
tcp.disconnect.return
```

Values

ret

Error code (0: no error)

name

Name of this probe

Context

The process which disconnects tcp

Name

tcp.setsockopt — Call to **setsockopt**

Synopsis

```
tcp.setsockopt
```

Values

optstr

Resolves optname to a human-readable format

level

The level at which the socket options will be manipulated

optlen

Used to access values for **setsockopt**

name

Name of this probe

optname

TCP socket options (e.g. TCP_NODELAY, TCP_MAXSEG, etc)

sock

Network socket

Context

The process which calls setsockopt

Name

tcp.setsockopt.return — Return from **setsockopt**

Synopsis

```
tcp.setsockopt.return
```

Values

ret

Error code (0: no error)

name

Name of this probe

Context

Context

The process which calls setsockopt

Name

tcp.receive — Called when a TCP packet is received

Synopsis

```
tcp.receive
```

Values

urg

TCP URG flag

psh

TCP PSH flag

rst

TCP RST flag

dport

TCP destination port

saddr

A string representing the source IP address

daddr

A string representing the destination IP address

ack

TCP ACK flag

syn

TCP SYN flag

fin

TCP FIN flag

sport

TCP source port

Name

udp.sendmsg — Fires whenever a process sends a UDP message

Synopsis

```
udp.sendmsg
```

Values

name

The name of this probe

size

Number of bytes sent by the process

sock

Network socket used by the process

Context

The process which sent a UDP message

Name

udp.sendmsg.return — Fires whenever an attempt to send a UDP message is completed

Synopsis

```
udp.sendmsg.return
```

Values

name

The name of this probe

size

Number of bytes sent by the process

Context

The process which sent a UDP message

Name

udp.recvmsg — Fires whenever a UDP message is received

Synopsis

```
udp.recvmsg
```

Values

name

The name of this probe

size

Number of bytes received by the process

sock

Network socket used by the process

Context

The process which received a UDP message

Name

udp.recvmsg.return — Fires whenever an attempt to receive a UDP message received is completed

Synopsis

```
udp.recvmsg.return
```

Values

name

The name of this probe

size

Number of bytes received by the process

Context

The process which received a UDP message

Name

udp.disconnect — Fires when a process requests for a UDP disconnection

Synopsis

```
udp.disconnect
```

Values

flags

Flags (e.g. FIN, etc)

name

The name of this probe

sock

Network socket used by the process

Context

The process which requests a UDP disconnection

Name

udp.disconnect.return — UDP has been disconnected successfully

Synopsis

```
udp.disconnect.return
```

Values

ret

Error code (0: no error)

name

The name of this probe

Context

The process which requested a UDP disconnection

Name

ip_ntop — returns a string representation from an integer IP number

Synopsis

```
function ip_ntop:string(addr:long)
```

Arguments

addr

the ip represented as an integer

Chapter 9. Socket Tapset

This family of probe points is used to probe socket activities. It contains the following probe points:

Name

socket.send — Message sent on a socket.

Synopsis

```
socket.send
```

Values

success

Was send successful? (1 = yes, 0 = no)

protocol

Protocol value

flags

Socket flags value

name

Name of this probe

state

Socket state value

size

Size of message sent (in bytes) or error code if success = 0

type

Socket type value

family

Protocol family value

Context

The message sender

Name

socket.receive — Message received on a socket.

Synopsis

```
socket.receive
```

Values

success

Was send successful? (1 = yes, 0 = no)

protocol

Protocol value

flags

Socket flags value

name

Name of this probe

state

Socket state value

size

Size of message received (in bytes) or error code if success = 0

type

Socket type value

family

Protocol family value

Context

The message receiver

Name

socket.sendmsg — Message is currently being sent on a socket.

Synopsis

```
socket.sendmsg
```

Values

protocol

Protocol value

flags

Socket flags value

name

Name of this probe

state

Socket state value

size

Message size in bytes

type

Socket type value

family

Protocol family value

Context

The message sender

Description

Fires at the beginning of sending a message on a socket via the the **sock_sendmsg** function

Name

socket.sendmsg.return — Return from **socket.sendmsg**.

Synopsis

```
socket.sendmsg.return
```

Values

success

Was send successful? (1 = yes, 0 = no)

protocol

Protocol value

flags

Socket flags value

name

Name of this probe

state

Socket state value

size

Size of message sent (in bytes) or error code if success = 0

type

Socket type value

family

Protocol family value

Context

The message sender.

Description

Fires at the conclusion of sending a message on a socket via the **sock_sendmsg** function

Name

socket.recvmsg — Message being received on socket

Synopsis

```
socket.recvmsg
```

Values

protocol

Protocol value

flags

Socket flags value

name

Name of this probe

state

Socket state value

size

Message size in bytes

type

Socket type value

family

Protocol family value

Context

The message receiver.

Description

Fires at the beginning of receiving a message on a socket via the **sock_recvmsg** function

---

Name

socket.recvmsg.return — Return from Message being received on socket

Synopsis

```
socket.recvmsg.return
```

Values

success

Was receive successful? (1 = yes, 0 = no)

protocol

Protocol value

flags

Socket flags value

name

Name of this probe

state

Socket state value

size

Size of message received (in bytes) or error code if success = 0

type

Socket type value

family

Protocol family value

Context

The message receiver.

Description

Fires at the conclusion of receiving a message on a socket via the **sock_recvmsg** function.

Name

socket.aio_write — Message send via **sock_aio_write**

Synopsis

```
socket.aio_write
```

Values

protocol

Protocol value

flags

Socket flags value

name

Name of this probe

state

Socket state value

size

Message size in bytes

type

Socket type value

family

Protocol family value

Context

The message sender

Description

Fires at the beginning of sending a message on a socket via the **sock_aio_write** function

Name

socket.aio_write.return — Conclusion of message send via **sock_aio_write**

Synopsis

```
socket.aio_write.return
```

Values

success

Was receive successful? (1 = yes, 0 = no)

protocol

Protocol value

flags

Socket flags value

name

Name of this probe

state

Socket state value

size

Size of message received (in bytes) or error code if success = 0

type

Socket type value

family

Protocol family value

Context

The message receiver.

Description

Fires at the conclusion of sending a message on a socket via the **sock_aio_write** function

---

Name

socket.aio_read — Receiving message via **sock_aio_read**

Synopsis

```
socket.aio_read
```

Values

protocol

Protocol value

flags

Socket flags value

name

Name of this probe

state

Socket state value

size

Message size in bytes

type

Socket type value

family

Protocol family value

Context

The message sender

Description

Fires at the beginning of receiving a message on a socket via the **sock_aio_read** function

Name

socket.aio_read.return — Conclusion of message received via **sock_aio_read**

Synopsis

```
socket.aio_read.return
```

Values

success

Was receive successful? (1 = yes, 0 = no)

protocol

Protocol value

flags

Socket flags value

name

Name of this probe

state

Socket state value

size

Size of message received (in bytes) or error code if success = 0

type

Socket type value

family

Protocol family value

Context

The message receiver.

Description

Fires at the conclusion of receiving a message on a socket via the **sock_aio_read** function

---

Name

socket.writev — Message sent via **socket_writev**

Synopsis

```
socket.writev
```

Values

protocol

Protocol value

flags

Socket flags value

name

Name of this probe

state

Socket state value

size

Message size in bytes

type

Socket type value

family

Protocol family value

Context

The message sender

Description

Fires at the beginning of sending a message on a socket via the **sock_writev** function

Name

socket.writev.return — Conclusion of message sent via **socket_writev**

Synopsis

```
socket.writev.return
```

Values

success

Was send successful? (1 = yes, 0 = no)

protocol

Protocol value

flags

Socket flags value

name

Name of this probe

state

Socket state value

size

Size of message sent (in bytes) or error code if success = 0

type

Socket type value

family

Protocol family value

Context

The message receiver.

Description

Fires at the conclusion of sending a message on a socket via the **sock_writev** function

Name

socket.readv — Receiving a message via **sock_readv**

Synopsis

```
socket.readv
```

Values

protocol

Protocol value

flags

Socket flags value

name

Name of this probe

state

Socket state value

size

Message size in bytes

type

Socket type value

family

Protocol family value

Context

The message sender

Description

Fires at the beginning of receiving a message on a socket via the **sock_readv** function

Name

socket.readv.return — Conclusion of receiving a message via **sock_readv**

Synopsis

```
socket.readv.return
```

Values

success

Was receive successful? (1 = yes, 0 = no)

protocol

Protocol value

flags

Socket flags value

name

Name of this probe

state

Socket state value

size

Size of message received (in bytes) or error code if success = 0

type

Socket type value

family

Protocol family value

Context

The message receiver.

Description

Fires at the conclusion of receiving a message on a socket via the **sock_readv** function

Name

socket.create — Creation of a socket

Synopsis

```
socket.create
```

Values

protocol

Protocol value

name

Name of this probe

requester

Requested by user process or the kernel (1 = kernel, 0 = user)

type

Socket type value

family

Protocol family value

Context

The requester (see requester variable)

Description

Fires at the beginning of creating a socket.

Name

socket.create.return — Return from Creation of a socket

Synopsis

```
socket.create.return
```

Values

success

Was socket creation successful? (1 = yes, 0 = no)

protocol

Protocol value

err

Error code if success == 0

name

Name of this probe

requester

Requested by user process or the kernel (1 = kernel, 0 = user)

type

Socket type value

family

Protocol family value

Context

The requester (user process or kernel)

Description

Fires at the conclusion of creating a socket.

Name

socket.close — Close a socket

Synopsis

```
socket.close
```

Values

protocol

Protocol value

flags

Socket flags value

name

Name of this probe

state

Socket state value

type

Socket type value

family

Protocol family value

Context

The requester (user process or kernel)

Description

Fires at the beginning of closing a socket.

Name

socket.close.return — Return from closing a socket

Synopsis

```
socket.close.return
```

Values

name

Name of this probe

Context

The requester (user process or kernel)

Description

Fires at the conclusion of closing a socket.

Name

sock_prot_num2str — Given a protocol number, return a string representation.

Synopsis

```
function sock_prot_num2str:string(proto:long)
```

Arguments

proto

The protocol number.

Name

sock_prot_str2num — Given a protocol name (string), return the corresponding protocol number.

Synopsis

```
function sock_prot_str2num:long(proto:string)
```

Arguments

proto

The protocol name.

Name

sock_fam_num2str — Given a protocol family number, return a string representation.

Synopsis

```
function sock_fam_num2str:string(family:long)
```

Arguments

family

The family number.

Name

sock_fam_str2num — Given a protocol family name (string), return the corresponding

Synopsis

```
function sock_fam_str2num:long(family:string)
```

Arguments

family

The family name.

Description

protocol family number.

Name

sock_state_num2str — Given a socket state number, return a string representation.

Synopsis

```
function sock_state_num2str:string(state:long)
```

Arguments

state

The state number.

Name

sock_state_str2num — Given a socket state string, return the corresponding state number.

Synopsis

```
function sock_state_str2num:long(state:string)
```

Arguments

state

The state name.

Chapter 10. Kernel Process Tapset

This family of probe points is used to probe process-related activities. It contains the following probe points:

Name

kprocess.create — Fires whenever a new process is successfully created

Synopsis

```
kprocess.create
```

Values

new_pid

The PID of the newly created process

Context

Parent of the created process.

Description

Fires whenever a new process is successfully created, either as a result of **`fork`** (or one of its syscall variants), or a new kernel thread.

Name

kprocess.start — Starting new process

Synopsis

```
kprocess.start
```

Values

None

Context

Newly created process.

Description

Description

Fires immediately before a new process begins execution.

Name

kprocess.exec — Attempt to exec to a new program

Synopsis

```
kprocess.exec
```

Values

filename

The path to the new executable

Context

The caller of exec.

Description

Fires whenever a process attempts to exec to a new program.

Name

kprocess.exec_complete — Return from exec to a new program

Synopsis

```
kprocess.exec_complete
```

Values

success

A boolean indicating whether the exec was successful

errno

The error number resulting from the exec

Context

On success, the context of the new executable. On failure, remains in the context of the caller.

Description

Fires at the completion of an exec call.

Name

kprocess.exit — Exit from process

Synopsis

```
kprocess.exit
```

Values

code

The exit code of the process

Context

The process which is terminating.

Description

Fires when a process terminates. This will always be followed by a kprocess.release, though the latter may be delayed if the process waits in a zombie state.

Name

kprocess.release — Process released

Synopsis

```
kprocess.release
```

Values

pid

PID of the process being released

task

A task handle to the process being released

Context

The context of the parent, if it wanted notification of this process' termination, else the context of the process itself.

Description

Fires when a process is released from the kernel. This always follows a kprocess.exit, though it may be delayed somewhat if the process waits in a zombie state.

Chapter 11. Signal Tapset

This family of probe points is used to probe signal activities. It contains the following probe points:

Name

signal.send — Signal being sent to a process

Synopsis

```
signal.send
```

Values

send2queue

Indicates whether the signal is sent to an existing **sigqueue**

name

The name of the function used to send out the signal

task

A task handle to the signal recipient

sinfo

The address of **siginfo** struct

si_code

Indicates the signal type

sig_name

A string representation of the signal

sig

The number of the signal

shared

Indicates whether the signal is shared by the thread group

sig_pid

The PID of the process receiving the signal

pid_name

The name of the signal recipient

Context

The signal's sender.

Name

signal.send.return — Signal being sent to a process completed

Synopsis

```
signal.send.return
```

Values

retstr

The return value to either **__group_send_sig_info**, **specific_send_sig_info**, or **send_sigqueue**

send2queue

Indicates whether the sent signal was sent to an existing **sigqueue**

name

The name of the function used to send out the signal

shared

Indicates whether the sent signal is shared by the thread group.

Context

The signal's sender.

Description

Possible **__group_send_sig_info** and **specific_send_sig_info** return values are as follows;

0 -- The signal is sucessfully sent to a process, which means that <1> the signal was ignored by the receiving process, <2> this is a non-RT signal and the system already has one queued, and <3> the signal was successfully added to the **sigqueue** of the receiving process.

-EAGAIN -- The **sigqueue** of the receiving process is overflowing, the signal was RT, and the signal was sent by a user using something other than **kill**.

Possible **send_group_sigqueue** and **send_sigqueue** return values are as follows;

0 -- The signal was either sucessfully added into the **sigqueue** of the receiving process, or a **SI_TIMER** entry is already queued (in which case, the overrun count will be simply incremented).

1 -- The signal was ignored by the receiving process.

-1 -- (**send_sigqueue** only) The task was marked **exiting**, allowing * **posix_timer_event** to redirect it to the group leader.

Name

signal.checkperm — Check being performed on a sent signal

Synopsis

```
signal.checkperm
```

Values

name

Name of the probe point; default value is **signal.checkperm**

task

A task handle to the signal recipient

sinfo

The address of the **siginfo** structure

si_code

Indicates the signal type

sig_name

A string representation of the signal

sig

The number of the signal

pid_name

Name of the process receiving the signal

sig_pid

The PID of the process receiving the signal

Name

signal.checkperm.return — Check performed on a sent signal completed

Synopsis

```
signal.checkperm.return
```

Values

retstr

Return value as a string

name

Name of the probe point; default value is **signal.checkperm**

Name

signal.wakeup — Sleeping process being wakened for signal

Synopsis

```
signal.wakeup
```

Values

resume

Indicates whether to wake up a task in a **STOPPED** or **TRACED** state

state_mask

A string representation indicating the mask of task states to wake. Possible values are **TASK_INTERRUPTIBLE**, **TASK_STOPPED**, **TASK_TRACED**, and **TASK_INTERRUPTIBLE**.

pid_name

Name of the process to wake

sig_pid

The PID of the process to wake

Name

signal.check_ignored — Checking to see signal is ignored

Synopsis

```
signal.check_ignored
```

Values

sig_name

A string representation of the signal

sig

The number of the signal

pid_name

Name of the process receiving the signal

sig_pid

The PID of the process receiving the signal

Name

signal.check_ignored.return — Check to see signal is ignored completed

Synopsis

```
signal.check_ignored.return
```

Values

retstr

Return value as a string

name

Name of the probe point; default value is **signal.checkperm**

Name

signal.force_segv — Forcing send of **SIGSEGV**

Synopsis

```
signal.force_segv
```

Values

sig_name

A string representation of the signal

sig

The number of the signal

pid_name

Name of the process receiving the signal

sig_pid

The PID of the process receiving the signal

Name

signal.force_segv.return — Forcing send of **SIGSEGV** complete

Synopsis

```
signal.force_segv.return
```

Values

retstr

Return value as a string

name

Name of the probe point; default value is **force_sigsegv**

Name

signal.syskill — Sending kill signal to a process

Synopsis

```
signal.syskill
```

Values

sig

The specific signal sent to the process

pid

The PID of the process receiving the signal

Name

signal.syskill.return — Sending kill signal completed

Synopsis

```
signal.syskill.return
```

Values

None

Name

signal.sys_tkill — Sending a kill signal to a thread

Synopsis

```
signal.sys_tkill
```

Values

sig_name

The specific signal sent to the process

sig

The specific signal sent to the process

pid

The PID of the process receiving the kill signal

Description

The **tkill** call is analogous to **kill(2)**, except that it also allows a process within a specific thread group to be targetted. Such processes are targetted through their unique thread IDs (TID).

Name

signal.systkill.return — Sending kill signal to a thread completed

Synopsis

```
signal.systkill.return
```

Values

None

Name

signal.sys_tgkill — Sending kill signal to a thread group

Synopsis

```
signal.sys_tgkill
```

Values

sig_name

A string representation of the signal

sig

The specific kill signal sent to the process

pid

The PID of the thread receiving the kill signal

tgid

The thread group ID of the thread receiving the kill signal

Description

The **tgkill** call is similar to **tkill**, except that it also allows the caller to specify the thread group ID of the thread to be signalled. This protects against TID reuse.

Name

signal.sys_tgkill.return — Sending kill signal to a thread group completed

Synopsis

```
signal.sys_tgkill.return
```

Values

None

Name

signal.send_sig_queue — Queuing a signal to a process

Synopsis

```
signal.send_sig_queue
```

Values

sigqueue_addr

The address of the signal queue

sig_name

A string representation of the signal

sig

The queued signal

pid_name

Name of the process to which the signal is queued

sig_pid

The PID of the process to which the signal is queued

Name

signal.send_sig_queue.return — Queuing a signal to a process completed

Synopsis

```
signal.send_sig_queue.return
```

Values

retstr

Return value as a string

Name

signal.pending — Examining pending signal

Synopsis

```
signal.pending
```

Values

sigset_size

The size of the user-space signal set

sigset_add

The address of the user-space signal set (**sigset_t**)

Description

This probe is used to examine a set of signals pending for delivery to a specific thread. This normally occurs when the **do_sigpending** kernel function is executed.

Name

signal.pending.return — Examination of pending signal completed

Synopsis

```
signal.pending.return
```

Values

retstr

Return value as a string

Name

signal.handle — Signal handler being invoked

Synopsis

```
signal.handle
```

Values

regs

The address of the kernel-mode stack area

sig_code

The **si_code** value of the **siginfo** signal

sig_mode

Indicates whether the signal was a user-mode or kernel-mode signal

sinfo

The address of the **siginfo** table

oldset_addr

The address of the bitmask array of blocked signals

sig

The signal number that invoked the signal handler

ka_addr

The address of the **k_sigaction** table associated with the signal

---

Name

signal.handle.return — Signal handler invocation completed

Synopsis

```
signal.handle.return
```

Values

retstr

Return value as a string

Name

signal.do_action — Examining or changing a signal action

Synopsis

```
signal.do_action
```

Values

sa_mask

The new mask of the signal

oldsigact_addr

The address of the old **sigaction** struct associated with the signal

sig

The signal to be examined/changed

sa_handler

The new handler of the signal

sigact_addr

The address of the new **sigaction** struct associated with the signal

---

Name

signal.do_action.return — Examining or changing a signal action completed

Synopsis

```
signal.do_action.return
```

Values

retstr

Return value as a string

Name

signal.procmask — Examining or changing blocked signals

Synopsis

```
signal.procmask
```

Values

how

Indicates how to change the blocked signals; possible values are **SIG_BLOCK=0** (for blocking signals), **SIG_UNBLOCK=1** (for unblocking signals), and **SIG_SETMASK=2** for setting the signal mask.

oldsigset_addr

The old address of the signal set (**sigset_t**)

sigset

The actual value to be set for **sigset_t**

sigset_addr

The address of the signal set (**sigset_t**) to be implemented

Name

signal.flush — Flusing all pending signals for a task

Synopsis

```
signal.flush
```

Values

task

The task handler of the process performing the flush

pid_name

The name of the process associated with the task performing the flush

sig_pid

The PID of the process associated with the task performing the flush

Appendix A. Revision History

Revision 1.0-5.400	**2013-10-31**	**Rüdiger Landmann**
Rebuild with publican 4.0.0		
Revision 1.0-5	**2012-07-18**	**Anthony Towns**
Rebuild for Publican 3.0		
Revision 1.0-0	**Wed Jun 17 2009**	**Don Domingo**
building book in RHEL		