

Name

bpftool-map – tool for inspection and simple manipulation of eBPF maps

SYNOPSIS

bpftool [*OPTIONS*] **map** *COMMAND*

OPTIONS := { { **-j** | **--json** } { **-p** | **--pretty** } } | { **-d** | **--debug** } | { **-f** | **--bpffs** } | { **-n** | **--nomount** } }

COMMANDS := { **show** | **list** | **create** | **dump** | **update** | **lookup** | **getnext** | **delete** | **pin** | **help** }

MAP COMMANDS

bpftool map { **show** | **list** } [*MAP*]

bpftool map create *FILE* *type* *TYPE* **key** *KEY_SIZE* **value** *VALUE_SIZE*
entries *MAX_ENTRIES* **name** *NAME* [**flags** *FLAGS*] [**inner_map** *MAP*]
[**offload_dev** *NAME*]

bpftool map dump *MAP*

bpftool map update *MAP* [**key** *DATA*] [**value** *VALUE*] [*UPDATE_FLAGS*]

bpftool map lookup *MAP* [**key** *DATA*]

bpftool map getnext *MAP* [**key** *DATA*]

bpftool map delete *MAP* **key** *DATA*

bpftool map pin *MAP* *FILE*

bpftool map event_pipe *MAP* [**cpu** *N* **index** *M*]

bpftool map peek *MAP*

bpftool map push *MAP* **value** *VALUE*

bpftool map pop *MAP*

bpftool map enqueue *MAP* **value** *VALUE*

bpftool map dequeue *MAP*

bpftool map freeze *MAP*

bpftool map help

MAP := { **id** *MAP_ID* | **pinned** *FILE* | **name** *MAP_NAME* }

DATA := { [**hex**] *BYTES* }

PROG := { **id** *PROG_ID* | **pinned** *FILE* | **tag** *PROG_TAG* | **name** *PROG_NAME* }

VALUE := { *DATA* | *MAP* | *PROG* }

UPDATE_FLAGS := { **any** | **exist** | **noexist** }

TYPE := { **hash** | **array** | **prog_array** | **perf_event_array** | **percpu_hash**
| **percpu_array** | **stack_trace** | **cgroup_array** | **lru_hash**
| **lru_percpu_hash** | **lpm_trie** | **array_of_maps** | **hash_of_maps**
| **devmap** | **devmap_hash** | **sockmap** | **cpumap** | **xskmap** | **sockhash**
| **cgroup_storage** | **reuseport_sockarray** | **percpu_cgroup_storage**
| **queue** | **stack** | **sk_storage** | **struct_ops** | **ringbuf** | **inode_storage**
| **task_storage** | **bloom_filter** | **user_ringbuf** | **cgrp_storage** | **arena**
| **insn_array** }

DESCRIPTION

bpftool map { **show** | **list** } [*MAP*]

Show information about loaded maps. If *MAP* is specified show information only about given maps, otherwise list all maps currently loaded on the system. In case of **name**, *MAP* may match several maps which will all be shown.

Output will start with map ID followed by map type and zero or more named attributes (depending on kernel version).

Since Linux 5.8 bpftool is able to discover information about processes that hold open file

descriptors (FDs) against BPF maps. On such kernels bpftool will automatically emit this information as well.

bpftool map create *FILE* **type** *TYPE* **key** *KEY_SIZE* **value** *VALUE_SIZE* **entries** *MAX_ENTRIES* **name** *NAME* [**flags** *FLAGS*] [**inner_map** *MAP*] [**offload_dev** *NAME*]

Create a new map with given parameters and pin it to *bpffs* as *FILE*.

FLAGS should be an integer which is the combination of desired flags, e.g. 1024 for **BPF_F_MMAPABLE** (see *bpf.h* UAPI header for existing flags).

To create maps of type array-of-maps or hash-of-maps, the **inner_map** keyword must be used to pass an inner map. The kernel needs it to collect metadata related to the inner maps that the new map will work with.

Keyword **offload_dev** expects a network interface name, and is used to request hardware offload for the map.

bpftool map dump *MAP*

Dump all entries in a given *MAP*. In case of *name*, *MAP* may match several maps which will all be dumped.

bpftool map update *MAP* [**key** *DATA*] [**value** *VALUE*] [*UPDATE_FLAGS*]

Update map entry for a given *KEY*.

UPDATE_FLAGS can be one of: **any** update existing entry or add if doesn't exist; **exist** update only if entry already exists; **noexist** update only if entry doesn't exist.

If the **hex** keyword is provided in front of the bytes sequence, the bytes are parsed as hexadecimal values, even if no "0x" prefix is added. If the keyword is not provided, then the bytes are parsed as decimal values, unless a "0x" prefix (for hexadecimal) or a "0" prefix (for octal) is provided.

bpftool map lookup *MAP* [**key** *DATA*]

Lookup *key* in the map.

bpftool map getnext *MAP* [**key** *DATA*]

Get next key. If *key* is not specified, get first key.

bpftool map delete *MAP* **key** *DATA*

Remove entry from the map.

bpftool map pin *MAP* *FILE*

Pin map *MAP* as *FILE*.

Note: *FILE* must be located in *bpffs* mount. It must not contain a dot character ('.'), which is reserved for future extensions of *bpffs*.

bpftool map event_pipe *MAP* [**cpu** *N* **index** *M*]

Read events from a **BPF_MAP_TYPE_PERF_EVENT_ARRAY** map.

Install perf rings into a perf event array map and dump output of any **bpf_perf_event_output()** call in the kernel. By default read the number of CPUs on the system and install perf ring for each CPU in the corresponding index in the array.

If **cpu** and **index** are specified, install perf ring for given **cpu** at **index** in the array (single ring).

Note that installing a perf ring into an array will silently replace any existing ring. Any other application will stop receiving events if it installed its rings earlier.

bpftool map peek MAP

Peek next value in the queue or stack.

bpftool map push MAP value VALUE

Push *VALUE* onto the stack.

bpftool map pop MAP

Pop and print value from the stack.

bpftool map enqueue MAP value VALUE

Enqueue *VALUE* into the queue.

bpftool map dequeue MAP

Dequeue and print value from the queue.

bpftool map freeze MAP

Freeze the map as read-only from user space. Entries from a frozen map can not longer be updated or deleted with the **bpf()** system call. This operation is not reversible, and the map remains immutable from user space until its destruction. However, read and write permissions for BPF programs to the map remain unchanged.

bpftool map help

Print short help message.

OPTIONS**-h, --help**

Print short help message (similar to **bpftool help**).

-V, --version

Print bpftool's version number (similar to **bpftool version**), the number of the libbpf version in use, and optional features that were included when bpftool was compiled. Optional features include linking against LLVM or libbfd to provide the disassembler for JIT-*ted* programs (**bpftool prog dump jited**) and usage of BPF skeletons (some features like **bpftool prog profile** or showing pids associated to BPF objects may rely on it).

-j, --json

Generate JSON output. For commands that cannot produce JSON, this option has no effect.

-p, --pretty

Generate human-readable JSON output. Implies **-j**.

-d, --debug

Print all logs available, even debug-level information. This includes logs from libbpf as well as from the verifier, when attempting to load programs.

-f, --bpffs

Show file names of pinned maps.

-n, --nomount

Do not automatically attempt to mount any virtual file system (such as tracefs or BPF virtual file system) when necessary.

EXAMPLES**# bpftool map show**

```
10: hash  name some_map  flags 0x0
      key 4B  value 8B  max_entries 2048  memlock 167936B
      pids systemd(1)
```

The following three commands are equivalent:

```
# bpftool map update id 10 key hex 20 c4 b7 00 value hex 0f ff ff ab 01 02 03 4c
# bpftool map update id 10 key 0x20 0xc4 0xb7 0x00 value 0x0f 0xff 0xff 0xab 0x01 0x02 0x03 0x4c
```

```
# bpftool map update id 10 key    32 196 183  0 value    15 255 255 171  1  2  3 76
```

```
# bpftool map lookup id 10 key 0 1 2 3
```

```
key: 00 01 02 03 value: 00 01 02 03 04 05 06 07
```

```
# bpftool map dump id 10
```

```
key: 00 01 02 03 value: 00 01 02 03 04 05 06 07
```

```
key: 0d 00 07 00 value: 02 00 00 00 01 02 03 04
```

```
Found 2 elements
```

```
# bpftool map getnext id 10 key 0 1 2 3
```

```
key:
```

```
00 01 02 03
```

```
next key:
```

```
0d 00 07 00
```

```
# mount -t bpf none /sys/fs/bpf/
```

```
# bpftool map pin id 10 /sys/fs/bpf/map
```

```
# bpftool map del pinned /sys/fs/bpf/map key 13 00 07 00
```

Note that map update can also be used in order to change the program references hold by a program array map. This can be used, for example, to change the programs used for tail-call jumps at runtime, without having to reload the entry-point program. Below is an example for this use case: we load a program defining a prog array map, and with a main function that contains a tail call to other programs that can be used either to "process" packets or to "debug" processing. Note that the prog array map **MUST** be pinned into the BPF virtual file system for the map update to work successfully, as kernel flushes prog array maps when they have no more references from user space (and the update would be lost as soon as bpftool exits).

```
# bpftool prog loadall tail_calls.o /sys/fs/bpf/foo type xdp
```

```
# bpftool prog --bpffs
```

```
545: xdp name main_func tag 674b4b5597193dc3 gpl
      loaded_at 2018-12-12T15:02:58+0000 uid 0
      xlated 240B jited 257B memlock 4096B map_ids 294
      pinned /sys/fs/bpf/foo/xdp
546: xdp name bpf_func_process tag e369a529024751fc gpl
      loaded_at 2018-12-12T15:02:58+0000 uid 0
      xlated 200B jited 164B memlock 4096B
      pinned /sys/fs/bpf/foo/process
547: xdp name bpf_func_debug tag 0b597868bc7f0976 gpl
      loaded_at 2018-12-12T15:02:58+0000 uid 0
      xlated 200B jited 164B memlock 4096B
      pinned /sys/fs/bpf/foo/debug
```

```
# bpftool map
```

```
294: prog_array name jmp_table flags 0x0
      key 4B value 4B max_entries 1 memlock 4096B
```

```
owner_prog_type xdp owner jited
```

```
# bpftool map pin id 294 /sys/fs/bpf/bar
# bpftool map dump pinned /sys/fs/bpf/bar
```

```
Found 0 elements
```

```
# bpftool map update pinned /sys/fs/bpf/bar key 0 0 0 0 value pinned /sys/fs/bpf/foo/debug
# bpftool map dump pinned /sys/fs/bpf/bar
```

```
key: 00 00 00 00 value: 22 02 00 00
Found 1 element
```

SEE ALSO

bpf(2), **bpf-helpers(7)**, **bpftool(8)**, **bpftool-btf(8)**, **bpftool-cgroup(8)**, **bpftool-feature(8)**, **bpftool-gen(8)**, **bpftool-iter(8)**, **bpftool-link(8)**, **bpftool-net(8)**, **bpftool-perf(8)**, **bpftool-prog(8)**, **bpftool-struct_ops(8)**, **bpftool-token(8)**