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Subject: Re: [PATCH] Fix rmmod/read/write races in /proc entries  
Posted by [Andrew Morton](#) on Tue, 23 Jan 2007 20:58:01 GMT  
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On Mon, 15 Jan 2007 18:39:27 +0300  
Alexey Dobriyan <[adobriyan@openvz.org](mailto:adobriyan@openvz.org)> wrote:

```
> -----
> pde = create_proc_entry()
> if (!pde)
>   return -ENOMEM;
> pde->write_proc = ...;
>   open
>   write
>   copy_from_user
> pde = create_proc_entry();
> if (!pde) {
>   remove_proc_entry();
>   return -ENOMEM;
>   /* module unloaded */
> }
>   *boom*
> -----
> pde = create_proc_entry();
> if (pde) {
>   /* which dereferences ->data */
>   pde->write_proc = ...;
>   open
>   write
>   pde->data = ...;
> }
> -----
>
> The following plan is going to be executed (as per Al Viro's explanations):
>
> PDE gets atomic counter counting reads and writes in progress
> via ->read_proc, ->write_proc, ->get_info . Generic proc code will bump
> PDE's counter before calling into module-specific method and decrement
> it after it returns.
>
> remove_proc_entry() will wait until all readers and writers are done.
> To do this reliably it will set ->proc_fops to NULL and generic proc
> code won't call into module if it sees NULL ->proc_fops.
>
> This patch implements part above. So far, no changes in modules code
> required. To proceed, lets look into ->proc_fops values during and after PDE
> creation:
>
```

```

> pde = create_proc_entry();
> if (pde)
>   pde->proc_fops = ...;
>
> proc_create() create empty PDE; (->proc_fops is NULL)
> proc_register() glues PDE to /proc (->proc_fops is NULL)
> proc_register() sets ->proc_fops to default (->proc_fops valid)
> [ module sets ->proc_fops to it's own (->proc_fops) valid ]
>
> Observation: ->proc_fops is not NULL, when create_proc_entry() exits.
>
> Next set of races come into play:
>
> pde = create_proc_entry();
> if (pde) {
>   pde->read_proc = ...;
>   pde->data = ...;
> }
>
> Almost all ->read_proc, ->write_proc callbacks assume that ->data is valid when
> they're called. They cast ->data and dereference it.
>
> To fix this we need a way to indicate that PDE is not readable and writeable.
> ->proc_fops nicely fits, because modules setting ->proc_fops only don't need
> changes at all. create_proc_entry() will exit with NULL ->proc_fops and helpers
> will be needed sometimes to set it.
>
> 1. Module sets ->proc_fops only
> no changes
> 2. Module sets ->data and ->proc_fops
> use a helper to set ->data before ->proc_fops and a barrier.
> 2. Module uses only create_proc_read_entry()
> changes only in create_proc_read_entry();
> 3. Module uses only create_proc_info_entry()
> changes only in create_proc_info_entry();
> 4. Module sets combination of ->data, ->read_proc, ->write_proc
> use helper which will set fields, barrier and sets default ->proc_fops.
> the best name I've come up so far is
>
> void set_proc_entry_data_rw(struct proc_dir_entry *, void *, read_proc_t, write_proc_t);
>
> Helper(s) will be introduced, then create_proc_entry() will start exiting with
> NULL ->proc_fops. After that use of helper(s) will become mandatory. Grepping
> for offenders will be easy (read_proc, ... are good names). ->data is bad
> name, however, after helpers will be plugged we can rename ->data to
> ->pde_data and it'll become good name.
>
> Sorry, for somewhat chaotic explanations, please, comment on patch and RFC.

```

<head spins>

Looks a bit hacky. Can this race not be fixed by addition of suitable locking, or possibly refcounting-under-locking?

```
> Signed-off-by: Alexey Dobriyan <adobriyan@openvz.org>
> ---
>
> fs/proc/generic.c      | 32 ++++++
> include/linux/proc_fs.h |  2 ++
> 2 files changed, 30 insertions(+), 4 deletions(-)
>
> --- a/fs/proc/generic.c
> +++ b/fs/proc/generic.c
> @@ -19,6 +19,7 @@ #include <linux/init.h>
> #include <linux/idr.h>
> #include <linux/namei.h>
> #include <linux/bitops.h>
> +#include <linux/delay.h>
> #include <linux/spinlock.h>
> #include <asm/uaccess.h>
>
> @@ -76,6 +77,12 @@ proc_file_read(struct file *file, char _
> if (!(page = (char*) __get_free_page(GFP_KERNEL)))
> return -ENOMEM;
>
> + if (!dp->proc_fops)
> + goto out_free;
> + atomic_inc(&dp->pde_users);
> + if (!dp->proc_fops)
> + goto out_dec;
> +
```

You'll be shocked to know that I'd prefer more comments in there. Enough for a later maintainer to be able to understand what's going on.

```
> while ((nbytes > 0) && !eof) {
> count = min_t(size_t, PROC_BLOCK_SIZE, nbytes);
>
> @@ -195,6 +202,9 @@ proc_file_read(struct file *file, char _
> buf += n;
> retval += n;
> }
> +out_dec:
> + atomic_dec(&dp->pde_users);
> +out_free:
```

```

> free_page((unsigned long) page);
> return retval;
> }
> @@ -205,14 +215,20 @@ proc_file_write(struct file *file, const
> {
> struct inode *inode = file->f_path.dentry->d_inode;
> struct proc_dir_entry * dp;
> + ssize_t rv;
>
> dp = PDE(inode);
>
> - if (!dp->write_proc)
> + if (!dp->write_proc || !dp->proc_fops)
> return -EIO;
>
> - /* FIXME: does this routine need ppos? probably... */
> - return dp->write_proc(file, buffer, count, dp->data);
> + rv = -EIO;
> + atomic_inc(&dp->pde_users);
> + if (dp->proc_fops)
> + /* FIXME: does this routine need ppos? probably... */
> + rv = dp->write_proc(file, buffer, count, dp->data);
> + atomic_dec(&dp->pde_users);
> + return rv;
> }

```

Here too.

```

>
> @@ -717,12 +733,20 @@ void remove_proc_entry(const char *name,
> if (!parent && xlate_proc_name(name, &parent, &fn) != 0)
> goto out;
> len = strlen(fn);
> -
> +again:
> spin_lock(&proc_subdir_lock);
> for (p = &parent->subdir; *p; p=(*p)->next ) {
> if (!proc_match(len, fn, *p))
> continue;
> de = *p;
> +
> + de->proc_fops = NULL;
> + if (atomic_read(&de->pde_users) > 0) {
> + spin_unlock(&proc_subdir_lock);
> + msleep(1);
> + goto again;
> + }
> +

```

And here.

```
> *p = de->next;
> de->next = NULL;
> if (S_ISDIR(de->mode))
> --- a/include/linux/proc_fs.h
> +++ b/include/linux/proc_fs.h
> @@ -66,6 +66,8 @@ struct proc_dir_entry {
>   atomic_t count; /* use count */
>   int deleted; /* delete flag */
>   void *set;
>   + atomic_t pde_users; /* number of readers + number of writers via
>   +   * ->read_proc, ->write_proc, ->get_info */
> };
>
> struct kcore_list {
```

---