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If MSG_COPY is set, then kernel will allocate dummy message with passed size, and then use new copy_msg() helper function to copy desired message (instead of unlinking it from the queue).

Notes:
1) Return -ENOSYS if MSG_COPY is specified, but CONFIG_CHECKPOINT_RESTORE is not set.

Signed-off-by: Stanislav Kinsbursky <skinsbursky@parallels.com>

---
include/uapi/linux/msg.h | 1 +
ipc/msg.c | 50 ++++++++++++++++++++++++++++++++++++++++++++--
ipc/msgutil.c | 38 +++++++++++++++++++++++++++++++++++
ipc/util.h | 1 +
4 files changed, 88 insertions(+), 2 deletions(-)

/* msgrcv options */
#define MSG_NOERROR 010000 /* no error if message is too big */
#define MSG_EXCEPT 020000 /* recv any msg except of specified type. */
+#define MSG_COPY 040000 /* copy (not remove) all queue messages */

/* Obsolete, used only for backwards compatibility and libc5 compiles */
struct msqid_ds {
}
struct msg_msg *copy = NULL;
unsigned long copy_number = 0;

if (msqid < 0 || (long) bufsz < 0)
    return -EINVAL;
if (msgflg & MSG_COPY) {
    #ifdef CONFIG_CHECKPOINT_RESTORE
        /*
         * Create dummy message to copy real message to.
         */
        +
    
    +copy = load_msg(buf, bufsz);
    +if (IS_ERR(copy))
        +return PTR_ERR(copy);
    +copy->m_ts = bufsz;
    +#else
    +#endif
    mode = convert_mode(&msgtyp, msgflg);
    ns = current->nsproxy->ipc_ns;
    
    msq = msg_lock_check(ns, msqid);
    -if (IS_ERR(msq))
        +if (IS_ERR(msq)) {
            +#ifdef CONFIG_CHECKPOINT_RESTORE
                +if (msgflg & MSG_COPY)
                    +free_msg(copy);
            +#endif
            +return PTR_ERR(msq);
        +}
    for (;;) {
        struct msg_receiver msr_d;
        struct list_head *tmp;
        +long msg_counter = 0;
        
        msg = ERR_PTR(-EACCES);
        if (ipcperms(ns, &msq->q_perm, S_IRUGO))
            @@ -821,8 +850,16 @@ long do_msgrcv(int msqid, void __user *buf, size_t bufsz, long msgtyp,
                if (mode == SEARCH_LESSEQUAL &&
                    walk_msg->m_type != 1) {
```c
msgtyp = walk_msg->m_type - 1;
+#ifdef CONFIG_CHECKPOINT_RESTORE
+} else if (msgflg & MSG_COPY) {
+if (copy_number == msg_counter) {
+msg = copy_msg(walk_msg, copy);
+break;
+}
+#endif
} else
break;

++msg_counter++;
}
tmp = tmp->next;
}
@@ -835,6 +872,10 @@ long do_msgrcv(int msqid, void __user *buf, size_t bufsz, long msgtyp,
 msg = ERR_PTR(-E2BIG);
goto out_unlock;
 }
+#ifdef CONFIG_CHECKPOINT_RESTORE
+if (msgflg & MSG_COPY)
+goto out_unlock;
+#endif
list_del(&msg->m_list);
msq->q_qnum--;
msq->q_rtime = get_seconds();
@@ -918,8 +959,13 @@ out_unlock:
 break;
 }
}
-if (IS_ERR(msg))
+if (IS_ERR(msg)) {
+#ifdef CONFIG_CHECKPOINT_RESTORE
+if (msgflg & MSG_COPY)
+free_msg(copy);
+#endif
 return PTR_ERR(msg);
+
 bufsz = msg_handler(buf, msg, bufsz);
 free_msg(msg);
diff --git a/ipc/msgutil.c b/ipc/msgutil.c
index 26143d3..b281f5c 100644
--- a/ipc/msgutil.c
+++ b/ipc/msgutil.c
@@ -100,7 +100,45 @@ out_err:
 free_msg(msg);
 return ERR_PTR(err);
+
```
```c
#ifdef CONFIG_CHECKPOINT_RESTORE
struct msg_msg *copy_msg(struct msg_msg *src, struct msg_msg *dst)
{
    struct msg_msgseg *dst_pseg, *src_pseg;
    int len = src->m_ts;
    int alen;
    
    BUG_ON(dst == NULL);
    if (src->m_ts > dst->m_ts)
        return ERR_PTR(-EINVAL);
    
    alen = len;
    if (alen > DATALEN_MSG)
        alen = DATALEN_MSG;
    
    dst->next = NULL;
    dst->security = NULL;
    
    memcpy(dst + 1, src + 1, alen);
    
    len -= alen;
    dst_pseg = dst->next;
    src_pseg = src->next;
    while (len > 0) {
        alen = len;
        if (alen > DATALEN_SEG)
            alen = DATALEN_SEG;
        
        memcpy(dst_pseg + 1, src_pseg + 1, alen);
        dst_pseg = dst_pseg->next;
        len -= alen;
        src_pseg = src_pseg->next;
    }
    
    dst->m_type = src->m_type;
    dst->m_ts = src->m_ts;
    
    return dst;
}
#endif

int store_msg(void __user *dest, struct msg_msg *msg, int len)
{
    int alen;
    
    int store_msg(void __user *dest, struct msg_msg *msg, int len)
    {
        int alen;
        
        return dst;
    }
#endif
```
Subject: Re: [PATCH v7 09/10] IPC: message queue copy feature introduced  
Posted by Michael Kerrisk (man-pages) on Thu, 18 Oct 2012 10:39:09 GMT

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On Thu, Oct 18, 2012 at 12:23 PM, Stanislav Kinsbursky <skinsbursky@parallels.com> wrote:
> This patch is required for checkpoint/restore in userspace.
> IOW, c/r requires some way to get all pending IPC messages without deleting
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> Notes:
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>     not set.

Stanislav,

A naive question, because I have not followed C/R closely. How do you
deal with the case that other processes may be reading from the queue?
(Or is that disabled during checkpointing?)

Thanks,

Michael

Subject: Re: [PATCH v7 09/10] IPC: message queue copy feature introduced  
Posted by Stanislav Kinsbursky on Thu, 18 Oct 2012 11:02:32 GMT

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18.10.2012 14:39, Michael Kerrisk (man-pages)
> On Thu, Oct 18, 2012 at 12:23 PM, Stanislav Kinsbursky
> <skinsbursky@parallels.com> wrote:
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Note, that in CRIU IPC resources will be collected when all processes to migrate are frozen.

Thanks,
Michael

--
Best regards,
Stanislav Kinsbursky

Subject: Re: [PATCH v7 09/10] IPC: message queue copy feature introduced
Posted by Michael Kerrisk (man- on Thu, 18 Oct 2012 11:18:17 GMT
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On Thu, Oct 18, 2012 at 1:02 PM, Stanislav Kinsbursky
<skinsbursky@parallels.com> wrote:
> 18.10.2012 14:39, Michael Kerrisk (man-pages)
> 
> >> On Thu, Oct 18, 2012 at 12:23 PM, Stanislav Kinsbursky
> >> <skinsbursky@parallels.com> wrote:
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For example, suppose a process reads and processes a message after you read it with MSG_COPY. Then the remaining messages are all shifted by one position, and you are going to miss reading one of them. IIUC the idea of MSG_COPY is to allow you to retrieve a copy of all messages in the list. It sounds like there's no way this can be done reliably. So, what possible use does the operation have?

Thanks,

Michael

--
Michael Kerrisk
Author of "The Linux Programming Interface"; http://man7.org/tlpi/

Subject: Re: [PATCH v7 09/10] IPC: message queue copy feature introduced
Posted by Stanislav Kinsbursky on Thu, 18 Oct 2012 11:34:47 GMT

On Thu, Oct 18, 2012 at 1:02 PM, Stanislav Kinsbursky
<<skinsbursky@parallels.com> wrote:

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Second, it's up to user-space how to handle such things. It's implied, that user, trying to migrate some process, holding one end of queue, will also migrate another process, holding second end.

Third, there is IPC namespace, which isolates IPC objects. It can be used for safe migration of process tree.

Thanks,
Subject: Re: [PATCH v7 09/10] IPC: message queue copy feature introduced
Posted by ebiederm on Thu, 18 Oct 2012 11:52:48 GMT

Stanislav Kinsbursky <skinsbursky@parallels.com> writes:

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you restart the processes.

Eric

Subject: Re: [PATCH v7 09/10] IPC: message queue copy feature introduced
Posted by Michael Kerrisk (man- on Thu, 18 Oct 2012 11:55:07 GMT

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>>>> deal with the case that other processes may be reading from the queue?
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http://git.criu.org/?p=crtools.git ;a=blob;f=ipc_ns.c;h=9e259f6fc04e0556bb722921545552e1c69f3;hb=HEAD

Sanity and reliability on the level you are talking about can be achieved, only if you'll freeze all message users before peeking.

--
Best regards,
Stanislav Kinsbursky

Subject: Re: [PATCH v7 09/10] IPC: message queue copy feature introduced
Posted by Michael Kerrisk (man-pages) on Thu, 18 Oct 2012 12:09:09 GMT

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Okay -- that's the piece I was looking for. Thanks.

In this scenario, how do you find all of the message users? Or do you simply ensure that everything is frozen beforehand?

Subject: Re: [PATCH v7 09/10] IPC: message queue copy feature introduced
Posted by ebiederm on Thu, 18 Oct 2012 12:20:54 GMT

"Michael Kerrisk (man-pages)" <mtk.manpages@gmail.com> writes:

>>> Is there somewhere a *detailed* description of how this feature would
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Okay -- that's the piece I was looking for. Thanks.

In this scenario, how do you find all of the message users? Or do you simply ensure that everything is frozen beforehand?

The general design is a container is started with a fresh set of namespaces and then the entire is frozen using the process freezer control group. With all of the userspace process frozen checkpoint then happens.

Eric

---

Subject: Re: [PATCH v7 09/10] IPC: message queue copy feature introduced
Posted by Stanislav Kinsbursky on Thu, 18 Oct 2012 12:41:34 GMT

18.10.2012 16:09, Michael Kerrisk (man-pages)

Is there somewhere a "detailed" description of how this feature would be used? Lacking that, it's really hard to see how anything sane and reliable can be done with MSG_COPY.

These patches are used by CRIU already. So, you can have a look at the CRIU source code:

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Sanity and reliability on the level you are talking about can be achieved, only if you'll freeze all message users before peeking.

Okay -- that's the piece I was looking for. Thanks.

In this scenario, how do you find all of the message users?
It looks like there is no way to how find these users. But I don't really think, that this is necessary. I.e. nothing protects the queue from reading by some alien (not expected) process in real life.

> Or do you simply ensure that everything is frozen beforehand?
>
In this particular case - yes.

--
Best regards,
Stanislav Kinsbursky

Subject: Re: [PATCH v7 09/10] IPC: message queue copy feature introduced
Posted by Stanislav Kinsbursky <skinsbursky@parallels.com> on Thu, 18 Oct 2012 14:40:01 GMT

18.10.2012 15:52, Eric W. Biederman
> Stanislav Kinsbursky <skinsbursky@parallels.com> writes:
> 
> >> First of all, this problem exist as is regardless to C/R feature or this patch
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> > you restart the processes.
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> It's not just an optimisation.
If crtools will fail (with SIGSEGV, for instance), then queue will be empty.
Subject: Re: [PATCH v7 09/10] IPC: message queue copy feature introduced
Posted by ebiederm on Fri, 19 Oct 2012 00:52:51 GMT
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Stanislav Kinsbursky <skinsbursky@parallels.com> writes:

> It's not just an optimisation.
> If crtools will fail (with SIGSEGV, for instance), then queue will be empty.

Regardless of what you call the benefit of this enhancement, this enhancement is not required to implement checkpoint/restart.

For reliability/restartability I suspect a simple enqueue/dequeue loop over each message in the queue would be nearly as proof against SIGSEGV and other failures.

So since all of these changes are enhancements we need to know what we are getting, over just sticking with the existing interfaces.

Unless there is a real bottleneck for something to work, I suspect the direction forward is to make checkpoint and restart work with the existing kernel interfaces and then revisit that decision when you actually have a real problem.

Eric

Subject: Re: [PATCH v7 09/10] IPC: message queue copy feature introduced
Posted by Stanislav Kinsbursky on Fri, 19 Oct 2012 07:44:33 GMT
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19.10.2012 04:52, Eric W. Biederman
> Stanislav Kinsbursky <skinsbursky@parallels.com> writes:
> 
>> It's not just an optimisation.
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> Regardless of what you call the benefit of this enhancement, this
To implement checkpoint/restart, an enhancement is not required. For reliability/restartability, a simple enqueue/dequeue loop over each message in the queue would be nearly as proof against SIGSEGV and other failures.

"Nearly as proof" is not good enough for CRIU quality of service. Moreover, if crtools will fail in this loop, not only one message will be lost, but also the queue messages order will be invalid.

So since all of these changes are enhancements, we need to know what we are getting, over just sticking with the existing interfaces.

Unless there is a real bottleneck for something to work, I suspect the direction forward is to make checkpoint and restart work with the existing kernel interfaces and then revisit that decision when you actually have a real problem.

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