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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(-)

diff --git a/include/uapi/linux/msg.h b/include/uapi/linux/msg.h
index 76999c9..c1af84a 100644
--- a/include/uapi/linux/msg.h
+++ b/include/uapi/linux/msg.h
@@ -11,6 +11,7 @@
 /* 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 {

diff --git a/ipc/msg.c b/ipc/msg.c
index 028ab87..a908529 100644
--- a/ipc/msg.c
+++ b/ipc/msg.c
@@ -789,19 +789,48 @@ long do_msgrcv(int msqid, void __user *buf, size_t bufsz, long msgtyp,  
 struct msg_msg *msg;
 int mode;
 struct ipc_namespace *ns;
+#ifdef CONFIG_CHECKPOINT_RESTORE
struct msg_msg *copy = NULL;
unsigned long copy_number = 0;
#endif

if (msqid < 0 || (long) bufsz < 0)
    return -EINVAL;
if (msgflg & MSG_COPY) {
    #ifdef CONFIG_CHECKPOINT_RESTORE
    
    if (msgflg & MSG_COPY) {
        copy_number = msgtyp;
        msgtyp = 0;
    }
    
    /*
     * 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
    return -ENOSYS;
    #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 (;;) {
    long msg_counter = 0;
    struct msg_receiver msr_d;
    struct list_head *tmp;
    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) {
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);
 }
+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;
diff --git a/ipc/util.h b/ipc/util.h
index 271bded..027f507 100644
--- a/ipc/util.h
+++ b/ipc/util.h
@@ -142,6 +142,7 @@ int ipc_parse_version (int *cmd);
extern void free_msg(struct msg_msg *msg);
extern struct msg_msg *load_msg(const void __user *src, int len);
+extern struct msg_msg *copy_msg(struct msg_msg *src, struct msg_msg *dst);
extern int store_msg(void __user *dest, struct msg_msg *msg, int len);

extern void recompute_msgmni(struct ipc_namespace *);

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.
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> Notes:
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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
On Thu, Oct 18, 2012 at 12:23 PM, Stanislav Kinsbursky <skinsbursky@parallels.com> wrote:

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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
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18.10.2012 15:18, Michael Kerrisk (man-pages)
> On Thu, Oct 18, 2012 at 1:02 PM, Stanislav Kinsbursky
> <skinsbursky@parallels.com> wrote:
>>> 18.10.2012 14:39, Michael Kerrisk (man-pages)
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First of all, this problem exist as is regardless to C/R feature or this patch set. If you share some resource (like message queue in this particular case) system-wide, then any process A can read out a message, which was send by process B to process C. So, when processes uses IPC message queues, they should be designed to handle such failures.

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.

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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:

> First of all, this problem exist as is regardless to C/R feature or this patch
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read all of the messages and then write all of the messages back before
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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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
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"Michael Kerrisk (man-pages)" <mtk.manpages@gmail.com> writes:

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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? 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.

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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:
> 
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> It's not just an optimisation. If crtools will fail (with SIGSEGV, for instance), then queue will be empty.
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
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> For reliability/restartability I suspect a simple enqueue/dequeue loop
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> and other failures.
>
> "Nearly as proof" is not good enough for CRIU quality of service.
Moreover, if crtools will fail in this loop, then 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.
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> Eric
>
> --

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