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Subject: containers development plans (July 20 version)

Posted by [serge](#) on Fri, 20 Jul 2007 17:36:15 GMT

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(If you missed earlier parts of this thread, you can catch earlier parts of this thread starting at [https://lists.linux-foundation.org/pipermail/containers/2007 -July/005860.html](https://lists.linux-foundation.org/pipermail/containers/2007-July/005860.html))

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I've added a 'use cases' section. That is where we attempt to explain to people not familiar with containers work why it is worth integrating upstream.

Srivatsa Vaddagiri is independently gathering additional information on specific task container subsystems. That will eventually be incorporated into the final version of this roadmap.

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We are trying to create a roadmap for the next year of 'container' development, to be reported to the upcoming kernel summit. Containers here is a bit of an ambiguous term, so we are taking it to mean all of:

1. namespaces  
kernel resource namespaces to support resource isolation and virtualization for virtual servers and application checkpoint/restart.
2. task containers framework  
the task containers (or, as Paul Jackson suggests, resource containers) framework by Paul Menage which especially provides a framework for subsystems which perform resource accounting and limits.
3. checkpoint/restart

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=Detailed development plans  
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A (still under construction) list of features we expect to be worked on next year looks like this:

1. completion of ongoing namespaces

- pid namespace
  - push merged patchset upstream
  - kthread cleanup
    - especially nfs
    - autofs
  - af\_unix credentials (stores pid\_t?)

- net namespace
  - ro bind mounts

## 2. continuation with new namespaces

- devpts, console, and ttydrivers
- user
- time
- namespace management tools
- namespace entering (using one of:)
  - bind\_ns()
  - ns container subsystem
  - (vs refuse this functionality)

- multiple /sys mounts
  - break /sys into smaller chunks?
  - shadow dirs vs namespaces

- multiple proc mounts
  - likely need to extend on the work done for pid namespaces
  - i.e. other /proc files will need some care

virtualization of statistics for 'top', etc

## 3. any additional work needed for virtual servers?

- i.e. in-kernel keyring usage for cross-namespace permissions, etc
  - nfs and rpc updates needed?
  - general security fixes
    - per-container capabilities?
  - device access controls
    - e.g. root in container should not have access to /dev/sda by default)
  - filesystems access controls

## 4. task containers functionality

- base features
  - virtualized containerfs mounts
    - to support vserver mgmnt of sub-containers
  - locking cleanup
  - control file API simplification
  - control file prefixing with subsystem name

userpace RBCE to provide controls for

- users

- groups

- pgrp

- executable

- specific containers
  - split cpusets into
    - cpuset

- memset
- network
  - connect/bind/accept controller using iptables
  - network flow id control
  - userspace per-container OOM handler
- per-container swap
- per-container disk I/O scheduling

### 5. checkpoint/restart

- memory c/r
  - (there are a few designs and prototypes)
  - (though this may be ironed out by then)
  - per-container swapfile?
- overall checkpoint strategy (one of:)
  - in-kernel
  - userspace-driven
  - hybrid
- overall restart strategy
  - use freezer API
  - use suspend-to-disk?
- sysvipc
  - "set identifier" syscall

pid namespace

- clone\_with\_pid()

==== Section 3 =====

=Use cases

==== Section 3 =====

### 1, Namespaces:

The most commonly listed uses for namespaces are virtual servers and checkpoint restart. Other uses are debugging (running tests in not-quite-virtual-servers) and resource isolation, such as the use of mounts namespaces to simulate multi-level directories for LSPP.

### 2. Task Containers:

(Vatsa to fill in)

### 3. Checkpoint/restart

load balancing:

applications can be migrated from high-load systems to ones with a lower load. Long-running applications can be checkpointed (or migrated) to start a short-running high-load job, then

restarted.

kernel upgrades:

A long-running application - or whole virtual server - can be migrated or checkpointed so that the system can be rebooted, and the application can continue to run

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In the list of stakeholders, I try to guess based on past comments and contributions what \*general\* area they are most likely to contribute in. I may try to narrow those down later, but am just trying to get something out the door right now before my next computer breaks.

Stakeholders:

Eric Biederman

everything

google

task containers

ibm (serge, dave, cedric, daniel)

namespaces

checkpoint/restart

bull (benjamin, pierre)

namespaces

checkpoint/restart

ibm (balbir, vatsa)

task containers

kerlabs

checkpoint/restart

openvz

everything

NEC Japan (Masahiko Takahashi)

checkpoint/restart

Linux-VServer

namespaces+containers

zap project

checkpoint/restart

planetlab

everything

hp

(i must have lost an email - what are they

interested in working on?)

XtreemOS

checkpoint/restart

Fujitsu/VA Linux Japan

resource control

Is anyone else still missing from the list?

thanks,  
-serge

---

Subject: Re: containers development plans (July 20 version)  
Posted by [Rohit Seth](#) on Fri, 20 Jul 2007 21:29:38 GMT  
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Thanks Serge for collecting these requirements. Have we decided on container mini summit? Couple of points that I want to add in task container functionality section (not sure if these are already covered by items below):

- 1- Per container dirty page (write throttling) limit.
- 2- Per container memory reclaim
- 3- network rate limiting (outbound) based on container
- 4- User level APIS to identify the resource limits that is allowed to a job, for example, how much physical memory a process can use. This should seamlessly integrated with non-container environment as well (may be with ulimit).
- 5- Similary, per container stats, like pages on active list, cpus usage etc. could also be very helpful.

Thanks,  
-rohit

On the taskOn Fri, 2007-07-20 at 12:36 -0500, Serge E. Hallyn wrote:  
> (If you missed earlier parts of this thread, you can catch earlier parts of  
> this thread starting at  
> [https://lists.linux-foundation.org/pipermail/containers/2007 -July/005860.html](https://lists.linux-foundation.org/pipermail/containers/2007-July/005860.html))  
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> Srivatsa Vaddagiri is independently gathering additional information  
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> 1. namespaces
>     kernel resource namespaces to support resource isolation
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> 2. task containers framework
>     the task containers (or, as Paul Jackson suggests, resource
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> 3. checkpoint/restart
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> ===== Section 2 =====
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> A (still under construction) list of features we expect to be worked on
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>
>     1. completion of ongoing namespaces
>         pid namespace
>             push merged patchset upstream
>             kthread cleanup
>                 especially nfs
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>             af_unix credentials (stores pid_t?)
>         net namespace
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>     2. continuation with new namespaces
>         devpts, console, and ttydrivers
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>         namespace entering (using one of:)
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>         multiple /sys mounts
>             break /sys into smaller chunks?
>             shadow dirs vs namespaces

```

- > multiple proc mounts
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```

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> The most commonly listed uses for namespaces are virtual
> servers and checkpoint restart. Other uses are debugging
> (running tests in not-quite-virtual-servers) and resource
> isolation, such as the use of mounts namespaces to simulate
> multi-level directories for LSPP.
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> 2. Task Containers:
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> (Vatsa to fill in)
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> 3. Checkpoint/restart
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> load balancing:
> applications can be migrated from high-load systems to ones
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> A long-running application - or whole virtual server - can
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> google  
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> namespaces  
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> Is anyone else still missing from the list?  
>  
> thanks,  
> -serge

---

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Subject: Re: containers development plans (July 20 version)  
Posted by [Paul Menage](#) on Sat, 21 Jul 2007 00:02:32 GMT  
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On 7/20/07, Serge E. Hallyn <[serge@hallyn.com](mailto:serge@hallyn.com)> wrote:

> 4. task containers functionality  
> base features  
> virtualized containerfs mounts  
> to support vserver mgmnt of sub-containers  
> locking cleanup  
> control file API simplification  
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This last point was actually in the set of patches that I sent to akpm today - probably it was too small an item to be worth including in this list.

> Stakeholders:  
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If the checkpoint/restart code is expected to evolve into a workable live migration system, we'd be interested in that too.

Paul

---

Subject: Re: containers development plans (July 20 version)  
Posted by [ebiederm](#) on Sat, 21 Jul 2007 01:00:45 GMT  
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"Paul Menage" <menage@google.com> writes:

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At least the support for live migration should be there.

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btw, that's also a req for resource management.

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- > namespaces+containers
- > zap project
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- > planetlab
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- > (i must have lost an email - what are they
- > interested in working on?)

they have been following net namespace closely. Their lab also did an interesting paper comparing containers (openvz) and virtual machine (Xen)

- > XtreamOS
- > checkpoint/restart
- > Fujitsu/VA Linux Japan
- > resource control
- >
- > Is anyone else still missing from the list?

I would add the BLCR opensource project maintained by Paul H. Hargrove (in cc:). BLCR is widely used in the HPC market but I would say it lacks kernel support in order to be perfect :)

thanks,

C.

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Containers mailing list  
Containers@lists.linux-foundation.org  
<https://lists.linux-foundation.org/mailman/listinfo/containers>

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Subject: Re: containers development plans (July 20 version)  
Posted by [serue](#) on Mon, 23 Jul 2007 14:24:18 GMT  
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Quoting Eric W. Biederman (ebiederm@xmission.com):

> "Paul Menage" <menage@google.com> writes:

>

>> On 7/20/07, Serge E. Hallyn <serge@hallyn.com> wrote:

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> > If the checkpoint/restart code is expected to evolve into a workable  
> > live migration system, we'd be interested in that too.  
>  
> At least the support for live migration should be there.

Yeah, sorry, I kind of take it for granted that when i say 'c/r' i would want live migration, but i shouldn't. Will spell that out.

thanks,  
-serge

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Containers mailing list  
Containers@lists.linux-foundation.org  
<https://lists.linux-foundation.org/mailman/listinfo/containers>

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Subject: Re: containers development plans (July 20 version)  
Posted by [serue](#) on Mon, 23 Jul 2007 14:27:45 GMT  
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Quoting Rohit Seth (rohitseth@google.com):  
> Thanks Serge for collecting these requirements. Have we decided on  
> container mini summit?

I think we've decided to have one, but someone needs to implement the details. Someone (Kirill?) mentioned having a "private" mini-summit for conference attendees, followed by a call-in conference. So we would need a meeting room and time at LCE, followed by a meeting room with a phone. I suppose someone's hotel room would work as well...

Personally I'd prefer to have just one mini-summit, with a live call-in phone number, so noone feels like there's shady back-room goings on. But on the other hand productivity of the mini-summit could be squashed by poor phone line quality or phone etiquette...

> Couple of points that I want to add in task  
> container functionality section (not sure if these are already covered  
> by items below):  
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> 5- Similary, per container stats, like pages on active list, cpus usage  
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