
Subject: [PATCH 4/4] mm: Allocate kernel pages to the right memcg
Posted by [Glauber Costa](#) on Fri, 08 Jun 2012 09:43:21 GMT

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This patch builds on the suggestion previously given by Cristoph, with one major difference: it still keeps the cache dispatcher and the cache duplicates. But its internals are completely different.

I no longer mess with the cache cores when pages are allocated. (except for destruction, that happens a bit later, but that's quite simple). All of that is done by the page allocator, by recognizing the `__GFP_SLABMEMCG` flag.

The catch here is that 99% of the time, the task doing the dispatch will be the same allocating the page. It doesn't hold only when tasks are moving around. But that's an acceptable price to pay, at least for me. Moving around won't break, it will at the most put us on a state where a cache has a page that is accounted to a different cgroup. Or, if that cgroups is destroyed, not accounted to anyone. If that ever hurts anyone, this is solvable by a reaper, or by a full cache scan when the task moves.

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```
---
include/linux/page-flags.h | 2 +-
include/linux/slub_def.h   | 15 ++++++-----
mm/memcontrol.c           | 2 ++
mm/page_alloc.c           | 13 ++++++-----
mm/slab.c                  | 4 +++++
mm/slub.c                  | 1 +
6 files changed, 30 insertions(+), 7 deletions(-)
```

```
diff --git a/include/linux/page-flags.h b/include/linux/page-flags.h
index c88d2a9..9b065d7 100644
--- a/include/linux/page-flags.h
+++ b/include/linux/page-flags.h
@@ -201,7 +201,7 @@
@@ PAGEFLAG(Dirty, dirty) TESTSCFLAG(Dirty, dirty)
__CLEARPAGEFLAG(Dirty, dirty)
PAGEFLAG(LRU, lru) __CLEARPAGEFLAG(LRU, lru)
PAGEFLAG(Active, active) __CLEARPAGEFLAG(Active, active)
TESTCLEARFLAG(Active, active)
-__PAGEFLAG(Slab, slab)
+__PAGEFLAG(Slab, slab) __TESTCLEARFLAG(Slab, slab)
PAGEFLAG(Checked, checked) /* Used by some filesystems */
```

```

PAGEFLAG(Pinned, pinned) TESTSCFLAG(Pinned, pinned) /* Xen */
PAGEFLAG(SavePinned, savepinned); /* Xen */
diff --git a/include/linux/slub_def.h b/include/linux/slub_def.h
index 7637f3b..32aa7a5 100644
--- a/include/linux/slub_def.h
+++ b/include/linux/slub_def.h
@@ -13,6 +13,8 @@
#include <linux/kobject.h>

#include <linux/kmemleak.h>
+#include <linux/memcontrol.h>
+#include <linux/mm.h>

enum stat_item {
  ALLOC_FASTPATH, /* Allocation from cpu slab */
@@ -209,14 +211,14 @@ static __always_inline int kmalloc_index(size_t size)
  * This ought to end up with a global pointer to the right cache
  * in kmalloc_caches.
  */
-static __always_inline struct kmem_cache *kmalloc_slab(size_t size)
+static __always_inline struct kmem_cache *kmalloc_slab(gfp_t flags, size_t size)
{
  int index = kmalloc_index(size);

  if (index == 0)
    return NULL;

- return kmalloc_caches[index];
+ return mem_cgroup_get_kmem_cache(kmalloc_caches[index], flags);
}

void *kmem_cache_alloc(struct kmem_cache *, gfp_t);
@@ -225,7 +227,10 @@ void *__kmalloc(size_t size, gfp_t flags);
static __always_inline void *
kmalloc_order(size_t size, gfp_t flags, unsigned int order)
{
- void *ret = (void *) __get_free_pages(flags | __GFP_COMP, order);
+ void *ret;
+
+ flags |= (__GFP_COMP | __GFP_SLABMEMCG);
+ ret = (void *) __get_free_pages(flags, order);
  kmemleak_alloc(ret, size, 1, flags);
  return ret;
}
@@ -274,7 +279,7 @@ static __always_inline void *kmalloc(size_t size, gfp_t flags)
  return kmalloc_large(size, flags);

  if (!(flags & SLUB_DMA)) {

```

```

- struct kmem_cache *s = kmalloc_slab(size);
+ struct kmem_cache *s = kmalloc_slab(flags, size);

    if (!s)
        return ZERO_SIZE_PTR;
@@ -307,7 +312,7 @@ static __always_inline void *kmalloc_node(size_t size, gfp_t flags, int
node)
{
    if (__builtin_constant_p(size) &&
        size <= SLUB_MAX_SIZE && !(flags & SLUB_DMA)) {
- struct kmem_cache *s = kmalloc_slab(size);
+ struct kmem_cache *s = kmalloc_slab(flags, size);

    if (!s)
        return ZERO_SIZE_PTR;
diff --git a/mm/memcontrol.c b/mm/memcontrol.c
index 45f7ece..9358140 100644
--- a/mm/memcontrol.c
+++ b/mm/memcontrol.c
@@ -510,6 +510,8 @@ static struct kmem_cache *kmem_cache_dup(struct mem_cgroup
*memcg,
    flags = s->flags & ~(SLAB_PANIC|SLAB_OFF_SLAB);
    new = kmem_cache_create_memcg(memcg, name, s->object_size, s->align,
        flags, s->ctor, s);
+ if (new)
+ new->allocflags |= __GFP_SLABMEMCG;

    kfree(name);
    return new;
diff --git a/mm/page_alloc.c b/mm/page_alloc.c
index a884a9c..b4322b7 100644
--- a/mm/page_alloc.c
+++ b/mm/page_alloc.c
@@ -2425,6 +2425,7 @@ __alloc_pages_nodemask(gfp_t gfp_mask, unsigned int order,
    struct page *page = NULL;
    int migratetype = allocflags_to_migratetype(gfp_mask);
    unsigned int cpuset_mems_cookie;
+ void *handle = NULL;

    gfp_mask &= gfp_allowed_mask;

@@ -2436,6 +2437,13 @@ __alloc_pages_nodemask(gfp_t gfp_mask, unsigned int order,
    return NULL;

    /*
+ * Will only have any effect when __GFP_SLABMEMCG is set.
+ * This is verified in the (always inline) callee
+ */

```

```

+ if (!mem_cgroup_new_kmem_page(gfp_mask, &handle, order))
+ return NULL;
+
+ /*
+  * Check the zones suitable for the gfp_mask contain at least one
+  * valid zone. It's possible to have an empty zonelist as a result
+  * of GFP_THISNODE and a memoryless node
@@ -2474,6 +2482,8 @@ out:
if (unlikely(!put_mems_allowed(cpuset_mems_cookie) && !page))
goto retry_cpuset;

+ mem_cgroup_commit_kmem_page(page, handle, order);
+
return page;
}
EXPORT_SYMBOL(__alloc_pages_nodemask);
@@ -2507,7 +2517,8 @@ EXPORT_SYMBOL(get_zeroed_page);
void __free_pages(struct page *page, unsigned int order)
{
if (put_page_testzero(page)) {
- __ClearPageSlab(page);
+ if (__TestClearPageSlab(page))
+ mem_cgroup_free_kmem_page(page, order);
if (order == 0)
free_hot_cold_page(page, 0);
else
diff --git a/mm/slab.c b/mm/slab.c
index 66ef370..1b19b34 100644
--- a/mm/slab.c
+++ b/mm/slab.c
@@ -3306,6 +3306,8 @@ __cache_alloc_node(struct kmem_cache *cachep, gfp_t flags, int
nodeid,
if (slab_should_failslab(cachep, flags))
return NULL;

+ cachep = mem_cgroup_get_kmem_cache(cachep, flags);
+
cache_alloc_debugcheck_before(cachep, flags);
local_irq_save(save_flags);

@@ -3391,6 +3393,8 @@ __cache_alloc(struct kmem_cache *cachep, gfp_t flags, void *caller)
if (slab_should_failslab(cachep, flags))
return NULL;

+ cachep = mem_cgroup_get_kmem_cache(cachep, flags);
+
cache_alloc_debugcheck_before(cachep, flags);
local_irq_save(save_flags);

```

```
objp = __do_cache_alloc(cachep, flags);
diff --git a/mm/slub.c b/mm/slub.c
index a0eeb4a..6994718 100644
--- a/mm/slub.c
+++ b/mm/slub.c
@@ -2304,6 +2304,7 @@ static __always_inline void *slab_alloc(struct kmem_cache *s,
if (slab_pre_alloc_hook(s, gfpflags))
return NULL;

+ s = mem_cgroup_get_kmem_cache(s, gfpflags);
redo:

/*
--
1.7.10.2
```
