Subject: [PATCH v4 23/25] memcg: propagate kmem limiting information to children
Posted by Glauber Costa on Mon, 18 Jun 2012 10:28:16 GMT
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The current memcg slab cache management fails to present satisfatory hierarchical
behavior in the following scenario:

-> /cgroups/memory/A/B/C

* kmem limit set at A
* A and B empty taskwise
* bash in C does find /

Because kmem_accounted is a boolean that was not set for C, no accounting
would be done. This is, however, not what we expect.

The basic idea, is that when a cgroup is limited, we walk the tree
upwards (something Kame and I already thought about doing for other purposes),
and make sure that we store the information about the parent being limited in
kmem_accounted (that is turned into a bitmap: two booleans would not be space
efficient). The code for that is taken from sched/core.c. My reasons for not
putting it into a common place is to dodge the type issues that would arise
from a common implementation between memcg and the scheduler - but I think
that it should ultimately happen, so if you want me to do it now, let me
know.

We do the reverse operation when a formerly limited cgroup becomes unlimited.

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---
 mm/memcontrol.c | 147 ++------
 1 file changed, 131 insertions(+), 16 deletions(-)

diff --git a/mm/memcontrol.c b/mm/memcontrol.c
index e32b53e..972e83f 100644
--- a/mm/memcontrol.c
+++ b/mm/memcontrol.c
@@ -259,6 +259,9 @@ struct mem_cgroup {
   * the counter to account for kernel memory usage.
   */
  struct res_counter kmem;
+

```
+ struct list_head children;
+ struct list_head siblings;
  /*
   * Per cgroup active and inactive list, similar to the
   * per zone LRU lists.
@@ -274,7 +277,11 @@ struct mem_cgroup {
   * Should the accounting and control be hierarchical, per subtree?
   */
  bool use_hierarchy;
- bool kmem_accounted;
+ /*
+  * bit0: accounted by this cgroup
+  * bit1: accounted by a parent.
+  */
+ volatile unsigned long kmem_accounted;

  bool  oom_lock;
  atomic_t under_oom;
@@ -332,6 +339,9 @@ struct mem_cgroup {
 #endif
 };

+#define KMEM_ACCOUNTED_THIS 0
+#define KMEM_ACCOUNTED_PARENT 1
+
 int memcg_css_id(struct mem_cgroup *memcg)
 {
  return css_id(&memcg->css);
@@ -474,7 +484,7 @@ void sock_release_memcg(struct sock *sk)

 static void disarm_static_keys(struct mem_cgroup *memcg)
 {
- if (memcg->kmem_accounted)
+ if (test_bit(KMEM_ACCOUNTED_THIS, &memcg->kmem_accounted))
   static_key_slow_dec(&mem_cgroup_kmem_enabled_key);
  /*
   * This check can't live in kmem destruction function,
@@ -4418,6 +4428,110 @@ static ssize_t mem_cgroup_read(struct cgroup *cont, struct cftype
*cft,
  len = scnprintf(str, sizeof(str), "%llu\n", (unsigned long long)val);
  return simple_read_from_buffer(buf, nbytes, ppos, str, len);
 }
+
+#ifdef CONFIG_CGROUP_MEM_RES_CTLR_KMEM
+typedef int (*memcg_visitor)(struct mem_cgroup*, void *);
+
+/*
+ * This is mostly "inspired" by the code in sched/core.c. I decided to copy it,
```

```
+ * instead of factoring it, because of all the typing issues we'd run into.
+ * In particular, grabbing the parent is very different for memcg, because we
+ * may or may not have hierarchy, while cpu cgroups always do. That would lead
+ * to either indirect calls - this is not a fast path for us, but can be for
+ * the scheduler - or a big and ugly macro.
+ *
+ * If we ever get rid of hierarchy, we could iterate over struct cgroup, and
+ * then it would cease to be a problem.
+ */
+int walk_tree_from(struct mem_cgroup *from,
+     memcg_visitor down, memcg_visitor up, void *data)
+{
+ struct mem_cgroup *parent, *child;
+ int ret;
+
+
+ parent = from;
+down:
+ ret = (*down)(parent, data);
+ if (ret)
+  goto out;
+
+ list_for_each_entry_rcu(child, &parent->children, siblings) {
+  parent = child;
+  goto down;
+
+up:
+  continue;
+ }
+ ret = (*up)(parent, data);
+ if (ret || parent == from)
+  goto out;
+
+ child = parent;
+ parent = parent_mem_cgroup(parent);
+ if (parent)
+  goto up;
+out:
+ return ret;
+}
+
+static int memcg_nop(struct mem_cgroup *memcg, void *data)
+{
+ return 0;
+}
+
+static int memcg_parent_account(struct mem_cgroup *memcg, void *data)
+{
```

```
+ if (memcg == data)
+  return 0;
+
+ set_bit(KMEM_ACCOUNTED_PARENT, &memcg->kmem_accounted);
+ return 0;
+}
+
+static int memcg_parent_no_account(struct mem_cgroup *memcg, void *data)
+{
+ if (memcg == data)
+  return 0;
+
+ clear_bit(KMEM_ACCOUNTED_PARENT, &memcg->kmem_accounted);
+ /*
+  * Stop propagation if we are accounted: our children should
+  * be parent-accounted
+  */
+ return test_bit(KMEM_ACCOUNTED_THIS, &memcg->kmem_accounted);
+}
+
+static void mem_cgroup_update_kmem_limit(struct mem_cgroup *memcg, u64 val)
+{
+ mutex_lock(&set_limit_mutex);
+ if (!test_and_set_bit(KMEM_ACCOUNTED_THIS, &memcg->kmem_accounted) &&
+  val != RESOURCE_MAX) {
+
+  /*
+   * Once enabled, can't be disabled. We could in theory
+   * disable it if we haven't yet created any caches, or
+   * if we can shrink them all to death.
+   *
+   * But it is not worth the trouble
+   */
+  static_key_slow_inc(&mem_cgroup_kmem_enabled_key);
+
+  rcu_read_lock();
+  walk_tree_from(memcg, memcg_parent_account, memcg_nop, memcg);
+  rcu_read_unlock();
+ } else if (test_and_clear_bit(KMEM_ACCOUNTED_THIS, &memcg->kmem_accounted)
+  && val == RESOURCE_MAX) {
+
+  rcu_read_lock();
+  walk_tree_from(memcg, memcg_parent_no_account,
+         memcg_nop, memcg);
+  rcu_read_unlock();
+ }
+
+ mutex_unlock(&set_limit_mutex);
```

```
+}
+#endif
 /*
  * The user of this function is...
  * RES_LIMIT.
@@ -4455,20 +4569,8 @@ static int mem_cgroup_write(struct cgroup *cont, struct cftype *cft,
    ret = res_counter_set_limit(&memcg->kmem, val);
    if (ret)
     break;
-   /*
-    * Once enabled, can't be disabled. We could in theory
-    * disable it if we haven't yet created any caches, or
-    * if we can shrink them all to death.
-    *
-    * But it is not worth the trouble
-    */
-   mutex_lock(&set_limit_mutex);
-   if (!memcg->kmem_accounted && val != RESOURCE_MAX
-       && !memcg->kmem_accounted) {
-    static_key_slow_inc(&mem_cgroup_kmem_enabled_key);
-    memcg->kmem_accounted = true;
-   }
-   mutex_unlock(&set_limit_mutex);
+   mem_cgroup_update_kmem_limit(memcg, val);
+   break;
   }
 #endif
   else
@@ -5527,6 +5629,8 @@ err_cleanup:

 }

+static DEFINE_MUTEX(memcg_list_mutex);
+
 static struct cgroup_subsys_state * __ref
 mem_cgroup_create(struct cgroup *cont)
 {
@@ -5542,6 +5646,7 @@ mem_cgroup_create(struct cgroup *cont)
   if (alloc_mem_cgroup_per_zone_info(memcg, node))
    goto free_out;

+ INIT_LIST_HEAD(&memcg->children);
  /* root ? */
  if (cont->parent == NULL) {
   int cpu;
@@ -5580,6 +5685,10 @@ mem_cgroup_create(struct cgroup *cont)
    * mem_cgroup(see mem_cgroup_put).
    */
```

```
   mem_cgroup_get(parent);
+
+  mutex_lock(&memcg_list_mutex);
+  list_add_rcu(&memcg->siblings, &parent->children);
+  mutex_unlock(&memcg_list_mutex);
  } else {
   res_counter_init(&memcg->res, NULL);
   res_counter_init(&memcg->memsw, NULL);
@@ -5622,9 +5731,15 @@ static int mem_cgroup_pre_destroy(struct cgroup *cont)
 static void mem_cgroup_destroy(struct cgroup *cont)
 {
  struct mem_cgroup *memcg = mem_cgroup_from_cont(cont);
+ struct mem_cgroup *parent = parent_mem_cgroup(memcg);

  kmem_cgroup_destroy(memcg);

+ mutex_lock(&memcg_list_mutex);
+ if (parent)
+  list_del_rcu(&memcg->siblings);
+ mutex_unlock(&memcg_list_mutex);
+
  mem_cgroup_put(memcg);
 }

--
1.7.10.2
```