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Subject: Re: [RFC] [PATCH] memory controller statistics  
Posted by [yamamoto](#) on Wed, 10 Oct 2007 01:01:17 GMT  
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hi,

> > i implemented some statistics for your memory controller.

here's a new version.

changes from the previous:

- make counters per-cpu.
- value \*= PAGE\_SIZE

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```
--- linux-2.6.23-rc8-mm2-stat/mm/memcontrol.c.BACKUP 2007-10-01 17:19:57.000000000 +0900
+++ linux-2.6.23-rc8-mm2-stat/mm/memcontrol.c 2007-10-09 13:41:43.000000000 +0900
@@ -25,6 +25,7 @@
#include <linux/backing-dev.h>
#include <linux/bit_spinlock.h>
#include <linux/rcupdate.h>
+#include <linux/seq_file.h>
#include <linux/swap.h>
#include <linux/spinlock.h>
#include <linux/fs.h>
@@ -34,6 +35,63 @@
struct cgroup_subsys mem_cgroup_subsys;
static const int MEM_CGROUP_RECLAIM_RETRIES = 5;

+enum mem_cgroup_stat_index {
+ /*
+  * for MEM_CONTAINER_TYPE_ALL, usage == pagecache + rss
+  */
+ MEM_CGROUP_STAT_PAGECACHE, /* # of pages charged as cache */
+ MEM_CGROUP_STAT_RSS, /* # of pages charged as rss */
+
+ /*
+  * redundant; usage == charge - uncharge
+  */
+ MEM_CGROUP_STAT_CHARGE, /* # of pages charged */
+ MEM_CGROUP_STAT_UNCHARGE, /* # of pages uncharged */
+
+ MEM_CGROUP_STAT_ACTIVE, /* # of pages on active_list */
+ MEM_CGROUP_STAT_INACTIVE, /* # of pages on inactive_list */
+
+ MEM_CGROUP_STAT_NSTATS,
```

```

+};
+
+static const struct mem_cgroup_stat_desc {
+ const char *msg;
+ u64 unit;
+} mem_cgroup_stat_desc[] = {
+ [MEM_CGROUP_STAT_PAGECACHE] = { "page_cache", PAGE_SIZE, },
+ [MEM_CGROUP_STAT_RSS] = { "rss", PAGE_SIZE, },
+ [MEM_CGROUP_STAT_CHARGE] = { "charge", PAGE_SIZE, },
+ [MEM_CGROUP_STAT_UNCHARGE] = { "uncharge", PAGE_SIZE, },
+ [MEM_CGROUP_STAT_ACTIVE] = { "active", PAGE_SIZE, },
+ [MEM_CGROUP_STAT_INACTIVE] = { "inactive", PAGE_SIZE, },
+};
+
+struct mem_cgroup_stat_cpu {
+ u64 count[MEM_CGROUP_STAT_NSTATS];
+} ____cacheline_aligned_in_smp;
+
+struct mem_cgroup_stat {
+ struct mem_cgroup_stat_cpu cpustat[NR_CPUS];
+};
+
+static inline void mem_cgroup_stat_inc(struct mem_cgroup_stat * stat,
+ enum mem_cgroup_stat_index idx)
+{
+ unsigned int cpu = get_cpu();
+
+ stat->cpustat[cpu].count[idx]++;
+ put_cpu();
+}
+
+static inline void mem_cgroup_stat_dec(struct mem_cgroup_stat * stat,
+ enum mem_cgroup_stat_index idx)
+{
+ unsigned int cpu = get_cpu();
+
+ stat->cpustat[cpu].count[idx]--;
+ put_cpu();
+}
+
+/*
+ * The memory controller data structure. The memory controller controls both
+ * page cache and RSS per cgroup. We would eventually like to provide
+ @@ -63,6 +121,11 @@ struct mem_cgroup {
+ */
+ spinlock_t lru_lock;
+ unsigned long control_type; /* control RSS or RSS+Pagecache */
+

```

```

+ /*
+  * statistics
+  */
+ struct mem_cgroup_stat stat;
+ };

/*
@@ -83,6 +146,9 @@ struct page_cgroup {
    struct mem_cgroup *mem_cgroup;
    atomic_t ref_cnt; /* Helpful when pages move b/w */
    /* mapped and cached states */
+ int flags;
+#define PCGF_PAGECACHE 1 /* charged as page cache */
+#define PCGF_ACTIVE 2 /* on active_list */
+ };

enum {
@@ -164,10 +230,24 @@ static void __always_inline unlock_page_

static void __mem_cgroup_move_lists(struct page_cgroup *pc, bool active)
{
- if (active)
- list_move(&pc->lru, &pc->mem_cgroup->active_list);
- else
- list_move(&pc->lru, &pc->mem_cgroup->inactive_list);
+ struct mem_cgroup *mem = pc->mem_cgroup;
+ struct mem_cgroup_stat *stat = &mem->stat;
+
+ if (active) {
+ list_move(&pc->lru, &mem->active_list);
+ if ((pc->flags & PCGF_ACTIVE) == 0) {
+ mem_cgroup_stat_dec(stat, MEM_CGROUP_STAT_INACTIVE);
+ mem_cgroup_stat_inc(stat, MEM_CGROUP_STAT_ACTIVE);
+ pc->flags |= PCGF_ACTIVE;
+ }
+ } else {
+ list_move(&pc->lru, &mem->inactive_list);
+ if ((pc->flags & PCGF_ACTIVE) != 0) {
+ mem_cgroup_stat_dec(stat, MEM_CGROUP_STAT_ACTIVE);
+ mem_cgroup_stat_inc(stat, MEM_CGROUP_STAT_INACTIVE);
+ pc->flags &= ~PCGF_ACTIVE;
+ }
+ }
+ }

/*
@@ -256,10 +336,11 @@ unsigned long mem_cgroup_isolate_pages(u
    * 0 if the charge was successful

```

```

* < 0 if the cgroup is over its limit
*/
-int mem_cgroup_charge(struct page *page, struct mm_struct *mm,
-   gfp_t gfp_mask)
+int mem_cgroup_charge_common(struct page *page, struct mm_struct *mm,
+   gfp_t gfp_mask, int is_cache)
{
    struct mem_cgroup *mem;
+ struct mem_cgroup_stat *stat;
    struct page_cgroup *pc, *race_pc;
    unsigned long flags;
    unsigned long nr_retries = MEM_CGROUP_RECLAIM_RETRIES;
@@ -365,8 +446,17 @@ noreclaim:
    atomic_set(&pc->ref_cnt, 1);
    pc->mem_cgroup = mem;
    pc->page = page;
+ pc->flags = (is_cache ? PCGF_PAGECACHE : 0) | PCGF_ACTIVE;
    page_assign_page_cgroup(page, pc);

+ stat = &mem->stat;
+ if (is_cache)
+   mem_cgroup_stat_inc(stat, MEM_CGROUP_STAT_PAGECACHE);
+ else
+   mem_cgroup_stat_inc(stat, MEM_CGROUP_STAT_RSS);
+   mem_cgroup_stat_inc(stat, MEM_CGROUP_STAT_CHARGE);
+   mem_cgroup_stat_inc(stat, MEM_CGROUP_STAT_ACTIVE);
+
    spin_lock_irqsave(&mem->lru_lock, flags);
    list_add(&pc->lru, &mem->active_list);
    spin_unlock_irqrestore(&mem->lru_lock, flags);
@@ -382,6 +472,14 @@ err:
    return -ENOMEM;
}

+int mem_cgroup_charge(struct page *page, struct mm_struct *mm,
+   gfp_t gfp_mask)
+{
+
+   return mem_cgroup_charge_common(page, mm, gfp_mask, 0);
+}
+
+/*
+ * See if the cached pages should be charged at all?
+ */
@@ -394,7 +492,7 @@ int mem_cgroup_cache_charge(struct page

    mem = rcu_dereference(mm->mem_cgroup);

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    if (mem->control_type == MEM_CGROUP_TYPE_ALL)
- return mem_cgroup_charge(page, mm, gfp_mask);
+ return mem_cgroup_charge_common(page, mm, gfp_mask, 1);
    else
        return 0;
}
@@ -417,7 +515,11 @@ void mem_cgroup_uncharge(struct page_cgr
    return;

    if (atomic_dec_and_test(&pc->ref_cnt)) {
+ struct mem_cgroup_stat *stat;
+ int is_cache;
+
    page = pc->page;
+ is_cache = (pc->flags & PCGF_PAGECACHE) != 0;
    lock_page_cgroup(page);
    mem = pc->mem_cgroup;
    css_put(&mem->css);
@@ -425,7 +527,19 @@ void mem_cgroup_uncharge(struct page_cgr
    unlock_page_cgroup(page);
    res_counter_uncharge(&mem->res, PAGE_SIZE);

+ stat = &mem->stat;
+ if (is_cache)
+ mem_cgroup_stat_dec(stat, MEM_CGROUP_STAT_PAGECACHE);
+ else
+ mem_cgroup_stat_dec(stat, MEM_CGROUP_STAT_RSS);
+ mem_cgroup_stat_inc(stat, MEM_CGROUP_STAT_UNCHARGE);
+ if ((pc->flags & PCGF_ACTIVE) != 0)
+ mem_cgroup_stat_dec(stat, MEM_CGROUP_STAT_ACTIVE);
+ else
+ mem_cgroup_stat_dec(stat, MEM_CGROUP_STAT_INACTIVE);
+
    spin_lock_irqsave(&mem->lru_lock, flags);
+ BUG_ON(list_empty(&pc->lru));
    list_del_init(&pc->lru);
    spin_unlock_irqrestore(&mem->lru_lock, flags);
    kfree(pc);
@@ -517,6 +631,49 @@ static ssize_t mem_control_type_read(str
    ppos, buf, s - buf);
}

+static void mem_cgroup_stat_init(struct mem_cgroup_stat *stat)
+{
+
+ memset(stat, 0, sizeof(*stat));
+}
+

```

```

+static int mem_control_stat_show(struct seq_file *m, void *arg)
+{
+ struct cgroup *cont = m->private;
+ struct mem_cgroup *mem_cont = mem_cgroup_from_cont(cont);
+ struct mem_cgroup_stat *stat = &mem_cont->stat;
+ int i;
+
+ for (i = 0; i < ARRAY_SIZE(stat->cpustat[0].count); i++) {
+ unsigned int cpu;
+ u64 val;
+
+ val = 0;
+ for (cpu = 0; cpu < NR_CPUS; cpu++)
+ val += stat->cpustat[cpu].count[i];
+
+ seq_printf(m, "%s %llu\n", mem_cgroup_stat_desc[i].msg,
+ (unsigned long long)(val * mem_cgroup_stat_desc[i].unit));
+ }
+
+ return 0;
+}
+
+static const struct file_operations mem_control_stat_file_operations = {
+ .read = seq_read,
+ .llseek = seq_lseek,
+ .release = single_release,
+};
+
+static int mem_control_stat_open(struct inode *unused, struct file *file)
+{
+ /* XXX __d_cont */
+ struct cgroup *cont = file->f_dentry->d_parent->d_fsdata;
+
+ file->f_op = &mem_control_stat_file_operations;
+ return single_open(file, mem_control_stat_show, cont);
+}
+
+static struct cftype mem_cgroup_files[] = {
+ {
+ .name = "usage_in_bytes",
+ @ -539,6 +696,10 @@ static struct cftype mem_cgroup_files[]
+ .write = mem_control_type_write,
+ .read = mem_control_type_read,
+ },
+ {
+ .name = "stat",
+ .open = mem_control_stat_open,
+ },

```

```
};

static struct mem_cgroup init_mem_cgroup;
@@ -562,6 +723,7 @@ mem_cgroup_create(struct cgroup_subsys *
    INIT_LIST_HEAD(&mem->inactive_list);
    spin_lock_init(&mem->lru_lock);
    mem->control_type = MEM_CGROUP_TYPE_ALL;
+ mem_cgroup_stat_init(&mem->stat);
    return &mem->css;
}
```

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Containers mailing list

Containers@lists.linux-foundation.org

<https://lists.linux-foundation.org/mailman/listinfo/containers>

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