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Subject: [PATCH] BC: resource beancounters (v3)  
Posted by [dev](#) on Tue, 29 Aug 2006 14:31:56 GMT  
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The following patch set presents base of Resource Beancounters (BC).  
BC allows to account and control consumption of kernel resources used by group of processes.

Draft UBC description on OpenVZ wiki can be found at [http://wiki.openvz.org/UBC\\_parameters](http://wiki.openvz.org/UBC_parameters)

The full BC patch set allows to control:

- kernel memory. All the kernel objects allocatable on user demand should be accounted and limited for DoS protection.

E.g. page tables, task structs, vmas etc.

- virtual memory pages. BCs allow to limit a container to some amount of memory and introduces 2-level OOM killer taking into account container's consumption.

pages shared between containers are correctly charged as fractions (tunable).

- network buffers. These includes TCP/IP rcv/snd buffers, dgram snd buffers, unix, netlinks and other buffers.

- minor resources accounted/limited by number: tasks, files, flocls, ptys, siginfo, pinned dcache mem, sockets, iptentries (for containers with virtualized networking)

As the first step we want to propose for discussion the most complicated parts of resource management: kernel memory and virtual memory.

The patch set to be sent provides core for BC and management of kernel memory only. Virtual memory management will be sent in a couple of days.

The patches in these series are:

diff-atomic-dec-and-lock-irqsave.patch  
introduce `atomic_dec_and_lock_irqsave()`

diff-bc-kconfig.patch:

Adds kernel/bc/Kconfig file with UBC options and includes it into arch Kconfigs

diff-bc-core.patch:

Contains core functionality and interfaces of BC:  
find/create beancounter, initialization,  
charge/uncharge of resource, core objects' declarations.

diff-bc-task.patch:

Contains code responsible for setting BC on task,  
it's inheriting and setting host context in interrupts.

Task contains three beancounters:

1. `exec_bc` - current context. all resources are charged to this beancounter.
2. `fork_bc` - beancounter which is inherited by task's children on fork

diff-bc-syscalls.patch:

Patch adds system calls for BC management:

1. `sys_get_bcid` - get current BC id
2. `sys_set_bcid` - changes `exec_` and `fork_` BCs on current
3. `sys_set_bclimit` - set limits for resources consumptions
4. `sys_get_bcstat` - returns limits/usages/fails for BC

diff-bc-kmem-core.patch:

Introduces `BC_KMEMSIZE` resource which accounts kernel objects allocated by task's request.

Objects are accounted via struct page and slab objects.  
For the latter ones each slab contains a set of pointers corresponding object is charged to.

Allocation charge rules:

1. Pages - if allocation is performed with `__GFP_BC` flag - page is charged to current's `exec_bc`.
2. Slabs - `kmem_cache` may be created with `SLAB_BC` flag - in this case each allocation is charged. Caches used by `kmalloc` are created with `SLAB_BC | SLAB_BC_NOCHARGE` flags. In this case only `__GFP_BC` allocations are charged.

diff-bc-kmem-charge.patch:

Adds `SLAB_BC` and `__GFP_BC` flags in appropriate places to cause charging/limiting of specified resources.

Summary of changes from v2 patch set:

- \* introduced `atomic_dec_and_lock_irqsave()`
- \* `bc_adjust_held_minmax` comment
- \* added `__must_check` for `bc_*charge*` funcs

- \* use hash\_long() instead of own one
- \* bc/Kconfig is sourced from init/Kconfig now
- \* introduced bclid\_t type with comment from Alan Cox
- \* check for barrier <= limit in sys\_set\_bclimit()
- \* removed (bc == NULL) checks
- \* replaced memcpy in beancounter\_findcrate with assignment
- \* moved check 'if (mask & BC\_ALLOC)' out of the lock
- \* removed unnecessary memset()

Summary of changes from v1 patch set:

- \* CONFIG\_BEANCOUNTERS is 'n' by default
- \* fixed Kconfig includes in arches
- \* removed hierarchical beancounters to simplify first patchset
- \* removed unused 'private' pointer
- \* removed unused EXPORTS
- \* MAXVALUE redeclared as LONG\_MAX
- \* beancounter\_findcreate clarification
- \* renamed UBC -> BC, ub -> bc etc.
- \* moved BC inheritance into copy\_process
- \* introduced reset\_exec\_bc() with proposed BUG\_ON
- \* removed task\_bc beancounter (not used yet, for numproc)
- \* fixed syscalls for sparc
- \* added sys\_get\_bcstat(): return info that was in /proc
- \* cond\_syscall instead of #ifdefs

Many thanks to Oleg Nesterov, Alan Cox, Matt Helsley and others for patch review and comments.

Patch set is applicable to 2.6.18-rc4-mm3

Thanks,  
Kirill

Subject: [PATCH 1/7] introduce atomic\_dec\_and\_lock\_irqsave()

Posted by [dev](#) on Tue, 29 Aug 2006 14:47:35 GMT

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Oleg Nesterov noticed to me that the construction like (used in beancounter patches and free\_uid()):

```
local_irq_save(flags);
if (atomic_dec_and_lock(&refcnt, &lock))
...

```

is not that good for preemptible kernels, since with preemption spin\_lock() can schedule() to reduce latency. However, it won't schedule

if interrupts are disabled.

So this patch introduces `atomic_dec_and_lock_irqsave()` as a logical counterpart to `atomic_dec_and_lock()`.

Signed-Off-By: Pavel Emelianov <xemul@sw.ru>

Signed-Off-By: Kirill Korotaev <dev@sw.ru>

---

```
include/linux/spinlock.h | 6 ++++++
kernel/user.c            | 5 +----
lib/dec_and_lock.c      | 19 ++++++
3 files changed, 26 insertions(+), 4 deletions(-)
```

--- ./include/linux/spinlock.h.dlirq 2006-08-28 10:17:35.000000000 +0400

+++ ./include/linux/spinlock.h 2006-08-28 11:22:37.000000000 +0400

```
@@ -266,6 +266,12 @@ extern int _atomic_dec_and_lock(atomic_t
#define atomic_dec_and_lock(atomic, lock) \
    __cond_lock(lock, _atomic_dec_and_lock(atomic, lock))
```

```
+extern int _atomic_dec_and_lock_irqsave(atomic_t *atomic, spinlock_t *lock,
+ unsigned long *flagsp);
```

```
+#define atomic_dec_and_lock_irqsave(atomic, lock, flags) \
```

```
+ __cond_lock(lock, \
+ _atomic_dec_and_lock_irqsave(atomic, lock, &flags))
```

```
+
/**
```

```
* spin_can_lock - would spin_trylock() succeed?
```

```
* @lock: the spinlock in question.
```

--- ./kernel/user.c.dlirq 2006-07-10 12:39:20.000000000 +0400

+++ ./kernel/user.c 2006-08-28 11:08:56.000000000 +0400

```
@@ -108,15 +108,12 @@ void free_uid(struct user_struct *up)
if (!up)
return;
```

```
- local_irq_save(flags);
```

```
- if (atomic_dec_and_lock(&up->__count, &uidhash_lock)) {
```

```
+ if (atomic_dec_and_lock_irqsave(&up->__count, &uidhash_lock, flags)) {
uid_hash_remove(up);
```

```
spin_unlock_irqrestore(&uidhash_lock, flags);
```

```
key_put(up->uid_keyring);
```

```
key_put(up->session_keyring);
```

```
kmem_cache_free(uid_cache, up);
```

```
- } else {
```

```
- local_irq_restore(flags);
```

```
}
```

```
}
```

```
--- ./lib/dec_and_lock.c.dlirq 2006-04-21 11:59:36.000000000 +0400
+++ ./lib/dec_and_lock.c 2006-08-28 11:22:08.000000000 +0400
@@ -33,3 +33,22 @@ int _atomic_dec_and_lock(atomic_t *atomi
}
```

```
EXPORT_SYMBOL(_atomic_dec_and_lock);
+
+/*
+ * the same, but takes the lock with _irqsave
+ */
+int _atomic_dec_and_lock_irqsave(atomic_t *atomic, spinlock_t *lock,
+ unsigned long *flagsp)
+{
+#ifdef CONFIG_SMP
+ if (atomic_add_unless(atomic, -1, 1))
+ return 0;
+#endif
+ spin_lock_irqsave(lock, *flagsp);
+ if (atomic_dec_and_test(atomic))
+ return 1;
+ spin_unlock_irqrestore(lock, *flagsp);
+ return 0;
+}
+
+EXPORT_SYMBOL(_atomic_dec_and_lock_irqsave);
```

---

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Subject: [PATCH 2/7] BC: kconfig  
Posted by [dev](#) on Tue, 29 Aug 2006 14:48:19 GMT  
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Add kernel/bc/Kconfig file with BC options and include it into arch Kconfigs

Signed-off-by: Pavel Emelianov <xemul@sw.ru>  
Signed-off-by: Kirill Korotaev <dev@sw.ru>

---

```
init/Kconfig | 2 ++
kernel/bc/Kconfig | 25 +++++
2 files changed, 27 insertions(+)
```

```
--- ./init/Kconfig.bckm 2006-07-10 12:39:10.000000000 +0400
+++ ./init/Kconfig 2006-07-28 14:10:41.000000000 +0400
@@ -222,6 +222,8 @@ source "crypto/Kconfig"
```

Say N if unsure.

```
+source "kernel/bc/Kconfig"
+
config SYSCTL
bool

--- ./kernel/bc/Kconfig.bckm 2006-07-28 13:07:38.000000000 +0400
+++ ./kernel/bc/Kconfig 2006-07-28 13:09:51.000000000 +0400
@@ -0,0 +1,25 @@
+#
+# Resource beancounters (BC)
+#
+# Copyright (C) 2006 OpenVZ. SWsoft Inc
+
+menu "User resources"
+
+config BEANCOUNTERS
+ bool "Enable resource accounting/control"
+ default n
+ help
+     When Y this option provides accounting and allows to configure
+     limits for user's consumption of exhaustible system resources.
+     The most important resource controlled by this patch is unswappable
+     memory (either mlock'ed or used by internal kernel structures and
+     buffers). The main goal of this patch is to protect processes
+     from running short of important resources because of an accidental
+     misbehavior of processes or malicious activity aiming to ``kill"
+     the system. It's worth to mention that resource limits configured
+     by setrlimit(2) do not give an acceptable level of protection
+     because they cover only small fraction of resources and work on a
+     per-process basis. Per-process accounting doesn't prevent malicious
+     users from spawning a lot of resource-consuming processes.
+
+endmenu
```

---

Subject: [PATCH 3/7] BC: beancounters core (API)  
Posted by [dev](#) on Tue, 29 Aug 2006 14:50:18 GMT  
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---

Core functionality and interfaces of BC:  
find/create beancounter, initialization,  
charge/uncharge of resource, core objects' declarations.

Basic structures:  
bc\_resource\_parm - resource description  
beancounter - set of resources, id, lock

Signed-off-by: Pavel Emelianov <xemul@sw.ru>  
Signed-off-by: Kirill Korotaev <dev@sw.ru>

---

```
include/bc/beancounter.h | 150 ++++++
include/linux/types.h   | 16 ++
init/main.c             | 4
kernel/Makefile         | 1
kernel/bc/Makefile      | 7 +
kernel/bc/beancounter.c | 256 ++++++
6 files changed, 434 insertions(+)
```

--- /dev/null 2006-07-18 14:52:43.075228448 +0400

+++ ./include/bc/beancounter.h 2006-08-28 12:47:52.000000000 +0400

@@ -0,0 +1,150 @@

+/\*

+ \* include/bc/beancounter.h

+ \*

+ \* Copyright (C) 2006 OpenVZ. SWsoft Inc

+ \*

+ \*/

+

+#ifndef \_LINUX\_BEANCOUNTER\_H

+#define \_LINUX\_BEANCOUNTER\_H

+

+/\*

+ \* Resource list.

+ \*/

+

+#define BC\_RESOURCES 0

+

+struct bc\_resource\_parm {

+ unsigned long barrier; /\* A barrier over which resource allocations

+ \* are failed gracefully. e.g. if the amount

+ \* of consumed memory is over the barrier

+ \* further sbrk() or mmap() calls fail, the

+ \* existing processes are not killed.

+ \*/

+ unsigned long limit; /\* hard resource limit \*/

+ unsigned long held; /\* consumed resources \*/

+ unsigned long maxheld; /\* maximum amount of consumed resources \*/

+ unsigned long minheld; /\* minimum amount of consumed resources \*/

+ unsigned long failcnt; /\* count of failed charges \*/

+};

+

+/\*

```

+ * Kernel internal part.
+ */
+
+#ifdef __KERNEL__
+
+#include <linux/spinlock.h>
+#include <linux/list.h>
+#include <asm/atomic.h>
+
+#define BC_MAXVALUE LONG_MAX
+
+/*
+ * Resource management structures
+ * Serialization issues:
+ * beancounter list management is protected via bc_hash_lock
+ * task pointers are set only for current task and only once
+ * refcount is managed atomically
+ * value and limit comparison and change are protected by per-bc spinlock
+ */
+
+struct beancounter {
+ atomic_t bc_refcount;
+ spinlock_t bc_lock;
+ bcid_t bc_id;
+ struct hlist_node hash;
+
+ /* resources statistics and settings */
+ struct bc_resource_parm bc_parms[BC_RESOURCES];
+};
+
+enum bc_severity { BC_BARRIER, BC_LIMIT, BC_FORCE };
+
+/* Flags passed to beancounter_findcreate() */
+#define BC_LOOKUP 0x00
+#define BC_ALLOC 0x01 /* May allocate new one */
+#define BC_ALLOC_ATOMIC 0x02 /* Allocate with GFP_ATOMIC */
+
+#define BC_HASH_BITS 8
+#define BC_HASH_SIZE (1 << BC_HASH_BITS)
+
+#ifdef CONFIG_BEANCOUNTERS
+
+/*
+ * This function tunes minheld and maxheld values for a given
+ * resource when held value changes
+ */
+static inline void bc_adjust_held_minmax(struct beancounter *bc,
+ int resource)

```



```

+{
+ struct bc_resource_parm *parm;
+
+ parm = &bc->bc_parms[resource];
+ if (parm->maxheld < parm->held)
+   parm->maxheld = parm->held;
+ if (parm->minheld > parm->held)
+   parm->minheld = parm->held;
+}
+
+int __must_check bc_charge_locked(struct beancounter *bc,
+ int res, unsigned long val, enum bc_severity strict);
+int __must_check bc_charge(struct beancounter *bc,
+ int res, unsigned long val, enum bc_severity strict);
+
+void bc_uncharge_locked(struct beancounter *bc, int res, unsigned long val);
+void bc_uncharge(struct beancounter *bc, int res, unsigned long val);
+
+struct beancounter *beancounter_findcreate(bcid_t id, int mask);
+
+static inline struct beancounter *get_beancounter(struct beancounter *bc)
+{
+ atomic_inc(&bc->bc_refcount);
+ return bc;
+}
+
+void put_beancounter(struct beancounter *bc);
+
+void bc_init_early(void);
+void bc_init_late(void);
+void bc_init_proc(void);
+
+extern struct beancounter init_bc;
+extern const char *bc_rnames[];
+
+#else /* CONFIG_BEANCOUNTERS */
+
+#define beancounter_findcreate(id, f) (NULL)
+#define get_beancounter(bc) (NULL)
+#define put_beancounter(bc) do { } while (0)
+
+static inline __must_check int bc_charge_locked(struct beancounter *bc,
+ int res, unsigned long val, enum bc_severity strict)
+{
+ return 0;
+}
+
+static inline __must_check int bc_charge(struct beancounter *bc,

```

```

+ int res, unsigned long val, enum bc_severity strict)
+{
+ return 0;
+}
+
+static inline void bc_uncharge_locked(struct beancounter *bc, int res,
+ unsigned long val)
+{
+}
+
+static inline void bc_uncharge(struct beancounter *bc, int res,
+ unsigned long val)
+{
+}
+
+#define bc_init_early()    do { } while (0)
+#define bc_init_late()    do { } while (0)
+#define bc_init_proc()    do { } while (0)
+
+#endif /* CONFIG_BEANCOUNTERS */
+#endif /* __KERNEL__ */
+
+#endif /* _LINUX_BEANCOUNTER_H */
--- ./include/linux/types.h.bccore 2006-08-28 12:20:13.000000000 +0400
+++ ./include/linux/types.h 2006-08-28 12:44:13.000000000 +0400
@@ -40,6 +40,21 @@ typedef __kernel_gid32_t gid_t;
typedef __kernel_uid16_t    uid16_t;
typedef __kernel_gid16_t    gid16_t;

+/*
+ * Type of beancounter id (CONFIG_BEANCOUNTERS)
+ *
+ * The ancient Unix implementations of this kind of resource management and
+ * security are built around setuid() which sets a uid value that cannot
+ * be changed again and is normally used for security purposes. That
+ * happened to be a uid_t and in simple setups at login uid = luid = euid
+ * would be the norm.
+ *
+ * Thus the Linux one happens to be a uid_t. It could be something else but
+ * for the "container per user" model whatever a container is must be able
+ * to hold all possible uid_t values. Alan Cox.
+ */
+typedef uid_t    bcid_t;
+
+#ifdef CONFIG_UID16
+/* This is defined by include/asm-{arch}/posix_types.h */
typedef __kernel_old_uid_t old_uid_t;
@@ -52,6 +67,7 @@ typedef __kernel_old_gid_t old_gid_t;

```

```

#else
typedef __kernel_uid_t uid_t;
typedef __kernel_gid_t gid_t;
+typedef __kernel_uid_t bcid_t;
#endif /* __KERNEL__ */

#if defined(__GNUC__) && !defined(__STRICT_ANSI__)
--- ./init/main.c.bccore 2006-08-28 12:20:13.000000000 +0400
+++ ./init/main.c 2006-08-28 12:43:34.000000000 +0400
@@ -52,6 +52,8 @@
#include <linux/debug_locks.h>
#include <linux/lockdep.h>

+#include <bc/beancounter.h>
+
#include <asm/io.h>
#include <asm/bugs.h>
#include <asm/setup.h>
@@ -495,6 +497,7 @@ asmlinkage void __init start_kernel(void
    early_boot_irqs_off();
    early_init_irq_lock_class();

+ bc_init_early();
/*
 * Interrupts are still disabled. Do necessary setups, then
 * enable them
@@ -587,6 +590,7 @@ asmlinkage void __init start_kernel(void
#endif
    fork_init(num_physpages);
    proc_caches_init();
+ bc_init_late();
    buffer_init();
    unnamed_dev_init();
    key_init();
--- ./kernel/Makefile.bccore 2006-08-28 12:20:13.000000000 +0400
+++ ./kernel/Makefile 2006-08-28 12:43:34.000000000 +0400
@@ -12,6 +12,7 @@ obj-y    = sched.o fork.o exec_domain.o

obj-$(CONFIG_STACKTRACE) += stacktrace.o
obj-y += time/
+obj-y += bc/
obj-$(CONFIG_DEBUG_MUTEXES) += mutex-debug.o
obj-$(CONFIG_LOCKDEP) += lockdep.o
ifeq ($(CONFIG_PROC_FS),y)
--- /dev/null 2006-07-18 14:52:43.075228448 +0400
+++ ./kernel/bc/Makefile 2006-08-28 12:43:34.000000000 +0400
@@ -0,0 +1,7 @@
+#

```

```

+# Beancounters (BC)
+#
+# Copyright (C) 2006 OpenVZ. SWsoft Inc
+#
+
+obj-$(CONFIG_BEANCOUNTERS) += beancounter.o
--- /dev/null 2006-07-18 14:52:43.075228448 +0400
+++ ./kernel/bc/beancounter.c 2006-08-28 12:49:07.000000000 +0400
@@ -0,0 +1,256 @@
+/*
+ * kernel/bc/beancounter.c
+ *
+ * Copyright (C) 2006 OpenVZ. SWsoft Inc
+ * Original code by (C) 1998 Alan Cox
+ * 1998-2000 Andrey Savochkin <saw@saw.sw.com.sg>
+ */
+
+#include <linux/slab.h>
+#include <linux/module.h>
+#include <linux/hash.h>
+
+#include <bc/beancounter.h>
+
+static kmem_cache_t *bc_cache;
+static struct beancounter default_beancounter;
+
+static void init_beancounter_struct(struct beancounter *bc, bcid_t id);
+
+struct beancounter init_bc;
+
+const char *bc_rnames[] = {
+};
+
+static struct hlist_head bc_hash[BC_HASH_SIZE];
+static spinlock_t bc_hash_lock;
+#define bc_hash_fn(bcid) (hash_long(bcid, BC_HASH_BITS))
+
+/*
+ * Per resource beancounting. Resources are tied to their bc id.
+ * The resource structure itself is tagged both to the process and
+ * the charging resources (a socket doesn't want to have to search for
+ * things at irq time for example). Reference counters keep things in
+ * hand.
+ *
+ * The case where a user creates resource, kills all his processes and
+ * then starts new ones is correctly handled this way. The refcounters
+ * will mean the old entry is still around with resource tied to it.
+ */

```

```

+
+struct beancounter *beancounter_findcreate(bcid_t id, int mask)
+{
+ struct beancounter *new_bc, *bc;
+ unsigned long flags;
+ struct hlist_head *slot;
+ struct hlist_node *pos;
+
+ slot = &bc_hash[bc_hash_fn(id)];
+ new_bc = NULL;
+
+retry:
+ spin_lock_irqsave(&bc_hash_lock, flags);
+ hlist_for_each_entry (bc, pos, slot, hash)
+ if (bc->bc_id == id)
+ break;
+
+ if (pos != NULL) {
+ get_beancounter(bc);
+ spin_unlock_irqrestore(&bc_hash_lock, flags);
+
+ if (new_bc != NULL)
+ kmem_cache_free(bc_cachep, new_bc);
+ return bc;
+ }
+
+ if (new_bc != NULL)
+ goto out_install;
+
+ spin_unlock_irqrestore(&bc_hash_lock, flags);
+
+ if (!(mask & BC_ALLOC))
+ goto out;
+
+ new_bc = kmem_cache_alloc(bc_cachep,
+ mask & BC_ALLOC_ATOMIC ? GFP_ATOMIC : GFP_KERNEL);
+ if (new_bc == NULL)
+ goto out;
+
+ *new_bc = default_beancounter;
+ init_beancounter_struct(new_bc, id);
+ goto retry;
+
+out_install:
+ hlist_add_head(&new_bc->hash, slot);
+ spin_unlock_irqrestore(&bc_hash_lock, flags);
+out:
+ return new_bc;

```

```

+}
+
+void put_beancounter(struct beancounter *bc)
+{
+ int i;
+ unsigned long flags;
+
+ if (!atomic_dec_and_lock_irqsave(&bc->bc_refcount,
+ &bc_hash_lock, flags))
+ return;
+
+ BUG_ON(bc == &init_bc);
+
+ for (i = 0; i < BC_RESOURCES; i++)
+ if (bc->bc_parms[i].held != 0)
+ printk("BC: %d has %lu of %s held on put", bc->bc_id,
+ bc->bc_parms[i].held, bc_rnames[i]);
+
+ hlist_del(&bc->hash);
+ spin_unlock_irqrestore(&bc_hash_lock, flags);
+
+ kmem_cache_free(bc_cachep, bc);
+}
+
+EXPORT_SYMBOL(put_beancounter);
+
+/*
+ * Generic resource charging stuff
+ */
+
+/* called with bc->bc_lock held and interrupts disabled */
+int bc_charge_locked(struct beancounter *bc, int resource, unsigned long val,
+ enum bc_severity strict)
+{
+ /*
+ * bc_value <= BC_MAXVALUE, value <= BC_MAXVALUE, and only one addition
+ * at the moment is possible so an overflow is impossible.
+ */
+ bc->bc_parms[resource].held += val;
+
+ switch (strict) {
+ case BC_BARRIER:
+ if (bc->bc_parms[resource].held >
+ bc->bc_parms[resource].barrier)
+ break;
+ /* fallthrough */
+ case BC_LIMIT:
+ if (bc->bc_parms[resource].held >

```

```

+ bc->bc_parms[resource].limit)
+ break;
+ /* fallthrough */
+ case BC_FORCE:
+ bc_adjust_held_minmax(bc, resource);
+ return 0;
+ default:
+ BUG();
+ }
+
+ bc->bc_parms[resource].failcnt++;
+ bc->bc_parms[resource].held -= val;
+ return -ENOMEM;
+}
+EXPORT_SYMBOL(bc_charge_locked);
+
+int bc_charge(struct beancounter *bc, int resource, unsigned long val,
+ enum bc_severity strict)
+{
+ int retval;
+ unsigned long flags;
+
+ BUG_ON(val > BC_MAXVALUE);
+
+ spin_lock_irqsave(&bc->bc_lock, flags);
+ retval = bc_charge_locked(bc, resource, val, strict);
+ spin_unlock_irqrestore(&bc->bc_lock, flags);
+ return retval;
+}
+EXPORT_SYMBOL(bc_charge);
+
+/* called with bc->bc_lock held and interrupts disabled */
+void bc_uncharge_locked(struct beancounter *bc, int resource, unsigned long val)
+{
+ if (unlikely(bc->bc_parms[resource].held < val)) {
+ printk("BC: overuncharging bc %d %s: val %lu, holds %lu\n",
+ bc->bc_id, bc_rnames[resource], val,
+ bc->bc_parms[resource].held);
+ val = bc->bc_parms[resource].held;
+ }
+
+ bc->bc_parms[resource].held -= val;
+ bc_adjust_held_minmax(bc, resource);
+}
+EXPORT_SYMBOL(bc_uncharge_locked);
+
+void bc_uncharge(struct beancounter *bc, int resource, unsigned long val)
+{

```

```

+ unsigned long flags;
+
+ spin_lock_irqsave(&bc->bc_lock, flags);
+ bc_uncharge_locked(bc, resource, val);
+ spin_unlock_irqrestore(&bc->bc_lock, flags);
+}
+EXPORT_SYMBOL(bc_uncharge);
+
+/*
+ * Initialization
+ *
+ * struct beancounter contains
+ * - limits and other configuration settings
+ * - structural fields: lists, spinlocks and so on.
+ *
+ * Before these parts are initialized, the structure should be memset
+ * to 0 or copied from a known clean structure. That takes care of a lot
+ * of fields not initialized explicitly.
+ */
+
+static void init_beancounter_struct(struct beancounter *bc, bcid_t id)
+{
+ atomic_set(&bc->bc_refcount, 1);
+ spin_lock_init(&bc->bc_lock);
+ bc->bc_id = id;
+}
+
+static void init_beancounter_nolimits(struct beancounter *bc)
+{
+ int k;
+
+ for (k = 0; k < BC_RESOURCES; k++) {
+ bc->bc_parms[k].limit = BC_MAXVALUE;
+ bc->bc_parms[k].barrier = BC_MAXVALUE;
+ }
+}
+
+static void init_beancounter_syslimits(struct beancounter *bc)
+{
+ int k;
+
+ for (k = 0; k < BC_RESOURCES; k++)
+ bc->bc_parms[k].barrier = bc->bc_parms[k].limit;
+}
+
+void __init bc_init_early(void)
+{
+ struct beancounter *bc;

```



```

+ struct hlist_head *slot;
+
+ bc = &init_bc;
+
+ init_beancounter_nolimits(bc);
+ init_beancounter_struct(bc, 0);
+
+ spin_lock_init(&bc_hash_lock);
+ slot = &bc_hash[bc_hash_fn(bc->bc_id)];
+ hlist_add_head(&bc->hash, slot);
+}
+
+void __init bc_init_late(void)
+{
+ struct beancounter *bc;
+
+ bc_cachep = kmem_cache_create("beancounters",
+ sizeof(struct beancounter),
+ 0, SLAB_HWCACHE_ALIGN|SLAB_PANIC,
+ NULL, NULL);
+
+ bc = &default_beancounter;
+ init_beancounter_syslimits(bc);
+ init_beancounter_struct(bc, 0);
+}

```

Subject: [PATCH 4/7] BC: context inheriting and changing

Posted by [dev](#) on Tue, 29 Aug 2006 14:51:35 GMT

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Contains code responsible for setting BC on task,  
it's inheriting and setting host context in interrupts.

Task references 2 beancounters:

1. exec\_bc: current context. all resources are charged to this beancounter.
3. fork\_bc: beancounter which is inherited by task's children on fork

Signed-off-by: Pavel Emelianov <xemul@sw.ru>

Signed-off-by: Kirill Korotaev <dev@sw.ru>

---

```

include/bc/task.h      | 59 +++++
include/linux/sched.h |  5 +
kernel/bc/Makefile    |  1

```

```

kernel/bc/beancounter.c | 3 ++
kernel/bc/misc.c      | 32 ++++++
kernel/fork.c         | 17 ++++++
kernel/irq/handle.c  | 9 ++++++
kernel/softirq.c     | 8 ++++++
8 files changed, 132 insertions(+), 2 deletions(-)

```

```

--- /dev/null 2006-07-18 14:52:43.075228448 +0400
+++ ./include/bc/task.h 2006-08-28 12:54:48.000000000 +0400
@@ -0,0 +1,59 @@
+/*
+ * include/bc/task.h
+ *
+ * Copyright (C) 2006 OpenVZ. SWsoft Inc
+ *
+ */
+
+#ifndef __BC_TASK_H_
+#define __BC_TASK_H_
+
+struct beancounter;
+
+struct task_beancounter {
+ struct beancounter *exec_bc;
+ struct beancounter *fork_bc;
+};
+
+#ifdef CONFIG_BEANCOUNTERS
+
+#define get_exec_bc() (current->task_bc.exec_bc)
+#define set_exec_bc(new) \
+({ \
+ struct beancounter *old; \
+ struct task_beancounter *tbc; \
+ tbc = &current->task_bc; \
+ old = tbc->exec_bc; \
+ tbc->exec_bc = new; \
+ old; \
+ })
+#define reset_exec_bc(old, exp) \
+ do { \
+ struct task_beancounter *tbc; \
+ tbc = &current->task_bc; \
+ BUG_ON(tbc->exec_bc != exp); \
+ tbc->exec_bc = old; \
+ } while (0)
+
+int __must_check bc_task_charge(struct task_struct *parent,

```



```

+obj-$(CONFIG_BEANCOUNTERS) += misc.o
--- ./kernel/bc/beancounter.c.bctask 2006-08-28 12:49:07.000000000 +0400
+++ ./kernel/bc/beancounter.c 2006-08-28 12:52:11.000000000 +0400
@@ -238,6 +238,9 @@ void __init bc_init_early(void)
    spin_lock_init(&bc_hash_lock);
    slot = &bc_hash[bc_hash_fn(bc->bc_id)];
    hlist_add_head(&bc->hash, slot);
+
+ current->task_bc.exec_bc = get_beancounter(bc);
+ current->task_bc.fork_bc = get_beancounter(bc);
}

```

```

void __init bc_init_late(void)
--- /dev/null 2006-07-18 14:52:43.075228448 +0400
+++ ./kernel/bc/misc.c 2006-08-28 12:52:11.000000000 +0400
@@ -0,0 +1,32 @@
+/*
+ * kernel/bc/misc.c
+ *
+ * Copyright (C) 2006 OpenVZ. SWsoft Inc.
+ *
+ */
+
+#include <linux/sched.h>
+
+#include <bc/beancounter.h>
+#include <bc/task.h>
+
+int bc_task_charge(struct task_struct *parent, struct task_struct *new)
+{
+ struct task_beancounter *old_bc;
+ struct task_beancounter *new_bc;
+ struct beancounter *bc;
+
+ old_bc = &parent->task_bc;
+ new_bc = &new->task_bc;
+
+ bc = old_bc->fork_bc;
+ new_bc->exec_bc = get_beancounter(bc);
+ new_bc->fork_bc = get_beancounter(bc);
+ return 0;
+}
+
+void bc_task_uncharge(struct task_struct *tsk)
+{
+ put_beancounter(tsk->task_bc.exec_bc);
+ put_beancounter(tsk->task_bc.fork_bc);
+}

```

```

--- ./kernel/fork.c.bctask 2006-08-28 12:20:13.000000000 +0400
+++ ./kernel/fork.c 2006-08-28 12:52:11.000000000 +0400
@@ -49,6 +49,8 @@
#include <linux/taskstats_kern.h>
#include <linux/random.h>

+#include <bc/task.h>
+
#include <asm/pgtable.h>
#include <asm/pgalloc.h>
#include <asm/uaccess.h>
@@ -103,12 +105,18 @@ kmem_cache_t *vm_area_cachep;
/* SLAB cache for mm_struct structures (tsk->mm) */
static kmem_cache_t *mm_cachep;

-void free_task(struct task_struct *tsk)
+static void __free_task(struct task_struct *tsk)
{
    free_thread_info(tsk->thread_info);
    rt_mutex_debug_task_free(tsk);
    free_task_struct(tsk);
}
+
+void free_task(struct task_struct *tsk)
+{
+ bc_task_uncharge(tsk);
+ __free_task(tsk);
+}
EXPORT_SYMBOL(free_task);

void __put_task_struct(struct task_struct *tsk)
@@ -983,6 +991,9 @@ static struct task_struct *copy_process(
    if (!p)
        goto fork_out;

+ if (bc_task_charge(current, p))
+ goto bad_charge;
+
#ifdef CONFIG_TRACE_IRQFLAGS
    DEBUG_LOCKS_WARN_ON(!p->hardirqs_enabled);
    DEBUG_LOCKS_WARN_ON(!p->softirqs_enabled);
@@ -1293,7 +1304,9 @@ bad_fork_cleanup_count:
    atomic_dec(&p->user->processes);
    free_uid(p->user);
bad_fork_free:
- free_task(p);
+ bc_task_uncharge(p);
+bad_charge:

```

```

+ __free_task(p);
fork_out:
  return ERR_PTR(retval);
}
--- ./kernel/irq/handle.c.bctask 2006-07-10 12:39:20.000000000 +0400
+++ ./kernel/irq/handle.c 2006-08-28 12:52:11.000000000 +0400
@@ -16,6 +16,9 @@
#include <linux/interrupt.h>
#include <linux/kernel_stat.h>

+#include <bc/beancounter.h>
+#include <bc/task.h>
+
#include "internals.h"

/**
@@ -166,6 +169,9 @@ fastcall unsigned int __do_IRQ(unsigned
  struct irq_desc *desc = irq_desc + irq;
  struct irqaction *action;
  unsigned int status;
+ struct beancounter *bc;
+
+ bc = set_exec_bc(&init_bc);

  kstat_this_cpu.irqs[irq]++;
  if (CHECK_IRQ_PER_CPU(desc->status)) {
@@ -178,6 +184,8 @@ fastcall unsigned int __do_IRQ(unsigned
  desc->chip->ack(irq);
  action_ret = handle_IRQ_event(irq, regs, desc->action);
  desc->chip->end(irq);
+
+ reset_exec_bc(bc, &init_bc);
  return 1;
}

@@ -246,6 +254,7 @@ out:
  desc->chip->end(irq);
  spin_unlock(&desc->lock);

+ reset_exec_bc(bc, &init_bc);
  return 1;
}

--- ./kernel/softirq.c.bctask 2006-08-28 12:20:13.000000000 +0400
+++ ./kernel/softirq.c 2006-08-28 12:52:11.000000000 +0400
@@ -18,6 +18,9 @@
#include <linux/rcupdate.h>
#include <linux/smp.h>

```

```

+#include <bc/beancounter.h>
+#include <bc/task.h>
+
#include <asm/irq.h>
/*
- No shared variables, all the data are CPU local.
@@ -209,6 +212,9 @@ asmlinkage void __do_softirq(void)
__u32 pending;
int max_restart = MAX_SOFTIRQ_RESTART;
int cpu;
+ struct beancounter *bc;
+
+ bc = set_exec_bc(&init_bc);

pending = local_softirq_pending();
account_system_vtime(current);
@@ -247,6 +253,8 @@ restart:

account_system_vtime(current);
__local_bh_enable();
+
+ reset_exec_bc(bc, &init_bc);
}

#ifdef __ARCH_HAS_DO_SOFTIRQ

```

---

Subject: [PATCH 5/7] BC: user interface (syscalls)  
Posted by [dev](#) on Tue, 29 Aug 2006 14:52:39 GMT  
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---

- Add the following system calls for BC management:
1. sys\_get\_bcid - get current BC id
  2. sys\_set\_bcid - change exec\_ and fork\_ BCs on current
  3. sys\_set\_bclimit - set limits for resources consumtions
  4. sys\_get\_bcstat - return br\_resource\_parm on resource

Signed-off-by: Pavel Emelianov <xemul@sw.ru>  
Signed-off-by: Kirill Korotaev <dev@sw.ru>

---

```

arch/i386/kernel/syscall_table.S | 4 +
arch/ia64/kernel/entry.S        | 4 +
arch/sparc/kernel/entry.S       | 2
arch/sparc/kernel/systbls.S     | 6 +
arch/sparc64/kernel/entry.S     | 2

```

```

arch/sparc64/kernel/systbls.S | 10 ++-
include/asm-i386/unistd.h     | 6 +
include/asm-ia64/unistd.h     | 6 +
include/asm-powerpc/systbl.h  | 4 +
include/asm-powerpc/unistd.h  | 6 +
include/asm-sparc/unistd.h    | 4 +
include/asm-sparc64/unistd.h  | 4 +
include/asm-x86_64/unistd.h   | 10 ++-
kernel/bc/Makefile            | 1
kernel/bc/sys.c                | 120 ++++++
kernel/sys_ni.c                | 6 +
16 files changed, 186 insertions(+), 9 deletions(-)

```

```

--- ./arch/i386/kernel/syscall_table.S.ve3 2006-08-21 13:15:37.000000000 +0400
+++ ./arch/i386/kernel/syscall_table.S 2006-08-21 14:15:47.000000000 +0400
@@ -318,3 +318,7 @@ ENTRY(sys_call_table)

```

```

    .long sys_vmsplice
    .long sys_move_pages
    .long sys_getcpu
+   .long sys_get_bcid
+   .long sys_set_bcid /* 320 */
+   .long sys_set_bclimit
+   .long sys_get_bcstat

```

```

--- ./arch/ia64/kernel/entry.S.ve3 2006-08-21 13:15:37.000000000 +0400
+++ ./arch/ia64/kernel/entry.S 2006-08-21 14:17:07.000000000 +0400
@@ -1610,5 +1610,9 @@ sys_call_table:

```

```

    data8 sys_sync_file_range // 1300
    data8 sys_tee
    data8 sys_vmsplice
+   data8 sys_get_bcid
+   data8 sys_set_bcid
+   data8 sys_set_bclimit // 1305
+   data8 sys_get_bcstat

```

```

    .org sys_call_table + 8*NR_syscalls // guard against failures to increase NR_syscalls
--- ./arch/sparc/kernel/entry.S.ve3 2006-07-10 12:39:10.000000000 +0400
+++ ./arch/sparc/kernel/entry.S 2006-08-21 14:29:44.000000000 +0400
@@ -37,7 +37,7 @@

```

```

#define curptr    g6

```

```

-#define NR_SYSCALLS 300 /* Each OS is different... */
+#define NR_SYSCALLS 304 /* Each OS is different... */

```

```

/* These are just handy. */

```

```

#define _SV save %sp, -STACKFRAME_SZ, %sp

```

```

--- ./arch/sparc/kernel/systbls.S.ve3 2006-07-10 12:39:10.000000000 +0400
+++ ./arch/sparc/kernel/systbls.S 2006-08-21 14:30:43.000000000 +0400

```



```

@@ -78,7 +78,8 @@ sys_call_table:
/*285*/ .long sys_mkdirat, sys_mknodat, sys_fchownat, sys_futimesat, sys_fstatat64
/*290*/ .long sys_unlinkat, sys_renameat, sys_linkat, sys_symlinkat, sys_readlinkat
/*295*/ .long sys_fchmodat, sys_faccessat, sys_pselect6, sys_ppoll, sys_unshare
-/*300*/ .long sys_set_robust_list, sys_get_robust_list
+/*300*/ .long sys_set_robust_list, sys_get_robust_list, sys_get_bcid, sys_set_bcid,
sys_set_bclimit
+/*305*/ .long sys_get_bcstat

#ifdef CONFIG_SUNOS_EMUL
/* Now the SunOS syscall table. */
@@ -192,4 +193,7 @@ sunos_sys_table:
.long sunos_nosys, sunos_nosys, sunos_nosys
.long sunos_nosys, sunos_nosys, sunos_nosys

+ .long sunos_nosys, sunos_nosys, sunos_nosys,
+ .long sunos_nosys
+
#endif
--- ./arch/sparc64/kernel/entry.S.ve3 2006-07-10 12:39:10.000000000 +0400
+++ ./arch/sparc64/kernel/entry.S 2006-08-21 14:29:56.000000000 +0400
@@ -25,7 +25,7 @@

#define curptr    g6

-#define NR_SYSCALLS 300    /* Each OS is different... */
+#define NR_SYSCALLS 304    /* Each OS is different... */

.text
.align 32
--- ./arch/sparc64/kernel/systbls.S.ve3 2006-07-10 12:39:11.000000000 +0400
+++ ./arch/sparc64/kernel/systbls.S 2006-08-21 14:32:26.000000000 +0400
@@ -79,7 +79,8 @@ sys_call_table32:
.word sys_mkdirat, sys_mknodat, sys_fchownat, compat_sys_futimesat, compat_sys_fstatat64
/*290*/ .word sys_unlinkat, sys_renameat, sys_linkat, sys_symlinkat, sys_readlinkat
.word sys_fchmodat, sys_faccessat, compat_sys_pselect6, compat_sys_ppoll, sys_unshare
-/*300*/ .word compat_sys_set_robust_list, compat_sys_get_robust_list
+/*300*/ .word compat_sys_set_robust_list, compat_sys_get_robust_list, sys_nis_syscall,
sys_nis_syscall, sys_nis_syscall
+ .word sys_nis_syscall

#endif /* CONFIG_COMPAT */

@@ -149,7 +150,9 @@ sys_call_table:
.word sys_mkdirat, sys_mknodat, sys_fchownat, sys_futimesat, sys_fstatat64
/*290*/ .word sys_unlinkat, sys_renameat, sys_linkat, sys_symlinkat, sys_readlinkat
.word sys_fchmodat, sys_faccessat, sys_pselect6, sys_ppoll, sys_unshare
-/*300*/ .word sys_set_robust_list, sys_get_robust_list

```

```
+/300*/ .word sys_set_robust_list, sys_get_robust_list, sys_get_bcid, sys_set_bcid,  
sys_set_bclimit  
+ .word sys_get_bcstat  
+
```

```
#if defined(CONFIG_SUNOS_EMUL) || defined(CONFIG_SOLARIS_EMUL) || \  
    defined(CONFIG_SOLARIS_EMUL_MODULE)  
@@ -263,4 +266,7 @@ sunos_sys_table:  
    .word sunos_nosys, sunos_nosys, sunos_nosys  
    .word sunos_nosys, sunos_nosys, sunos_nosys  
    .word sunos_nosys, sunos_nosys, sunos_nosys  
+  
+ .word sunos_nosys, sunos_nosys, sunos_nosys  
+ .word sunos_nosys  
#endif
```

```
--- ./include/asm-i386/unistd.h.ve3 2006-08-21 13:15:39.000000000 +0400  
+++ ./include/asm-i386/unistd.h 2006-08-21 14:22:53.000000000 +0400  
@@ -324,10 +324,14 @@  
#define __NR_vmsplice 316  
#define __NR_move_pages 317  
#define __NR_getcpu 318  
+#define __NR_get_bcid 319  
+#define __NR_set_bcid 320  
+#define __NR_set_bclimit 321  
+#define __NR_get_bcstat 322
```

```
#ifdef __KERNEL__
```

```
-#define NR_syscalls 318  
+#define NR_syscalls 323  
#include <linux/err.h>
```

```
/*
```

```
--- ./include/asm-ia64/unistd.h.ve3 2006-07-10 12:39:19.000000000 +0400  
+++ ./include/asm-ia64/unistd.h 2006-08-21 14:24:29.000000000 +0400  
@@ -291,11 +291,15 @@  
#define __NR_sync_file_range 1300  
#define __NR_tee 1301  
#define __NR_vmsplice 1302  
+#define __NR_get_bcid 1303  
+#define __NR_set_bcid 1304  
+#define __NR_set_bclimit 1305  
+#define __NR_get_bcstat 1306
```

```
#ifdef __KERNEL__
```

```
-#define NR_syscalls 279 /* length of syscall table */
```

```

+#define NR_syscalls 283 /* length of syscall table */

#define __ARCH_WANT_SYS_RT_SIGACTION

--- ./include/asm-powerpc/systbl.h.ve3 2006-07-10 12:39:19.000000000 +0400
+++ ./include/asm-powerpc/systbl.h 2006-08-21 14:28:46.000000000 +0400
@@ -304,3 +304,7 @@ SYSCALL_SPU(fchmodat)
SYSCALL_SPU(faccessat)
COMPAT_SYS_SPU(get_robust_list)
COMPAT_SYS_SPU(set_robust_list)
+SYSCALL(sys_get_bcid)
+SYSCALL(sys_set_bcid)
+SYSCALL(sys_set_bclimit)
+SYSCALL(sys_get_bcstat)
--- ./include/asm-powerpc/unistd.h.ve3 2006-07-10 12:39:19.000000000 +0400
+++ ./include/asm-powerpc/unistd.h 2006-08-21 14:28:24.000000000 +0400
@@ -323,10 +323,14 @@
#define __NR_faccessat 298
#define __NR_get_robust_list 299
#define __NR_set_robust_list 300
+#define __NR_get_bcid 301
+#define __NR_set_bcid 302
+#define __NR_set_bclimit 303
+#define __NR_get_bcstat 304

#ifdef __KERNEL__

-#define __NR_syscalls 301
+#define __NR_syscalls 305

#define __NR__exit __NR__exit
#define NR_syscalls __NR_syscalls
--- ./include/asm-sparc/unistd.h.ve3 2006-07-10 12:39:19.000000000 +0400
+++ ./include/asm-sparc/unistd.h 2006-08-21 14:33:20.000000000 +0400
@@ -318,6 +318,10 @@
#define __NR_unshare 299
#define __NR_set_robust_list 300
#define __NR_get_robust_list 301
+#define __NR_get_bcid 302
+#define __NR_set_bcid 303
+#define __NR_set_bclimit 304
+#define __NR_get_bcstat 305

#ifdef __KERNEL__
/* WARNING: You MAY NOT add syscall numbers larger than 301, since
--- ./include/asm-sparc64/unistd.h.ve3 2006-07-10 12:39:19.000000000 +0400
+++ ./include/asm-sparc64/unistd.h 2006-08-21 14:34:10.000000000 +0400
@@ -320,6 +320,10 @@

```

```

#define __NR_unshare 299
#define __NR_set_robust_list 300
#define __NR_get_robust_list 301
+#define __NR_get_bcid 302
+#define __NR_set_bcid 303
+#define __NR_set_bclimit 304
+#define __NR_get_bcstat 305

#ifdef __KERNEL__
/* WARNING: You MAY NOT add syscall numbers larger than 301, since
--- ./include/asm-x86_64/unistd.h.ve3 2006-08-21 13:15:39.000000000 +0400
+++ ./include/asm-x86_64/unistd.h 2006-08-21 14:35:19.000000000 +0400
@@ -619,10 +619,18 @@ __SYSCALL(__NR_sync_file_range, sys_sync
__SYSCALL(__NR_vmsplice, sys_vmsplice)
#define __NR_move_pages 279
__SYSCALL(__NR_move_pages, sys_move_pages)
+#define __NR_get_bcid 280
+__SYSCALL(__NR_get_bcid, sys_get_bcid)
+#define __NR_set_bcid 281
+__SYSCALL(__NR_set_bcid, sys_set_bcid)
+#define __NR_set_bclimit 282
+__SYSCALL(__NR_set_bclimit, sys_set_bclimit)
+#define __NR_get_bcstat 283
+__SYSCALL(__NR_get_bcstat, sys_get_bcstat)

#ifdef __KERNEL__

-#define __NR_syscall_max __NR_move_pages
+#define __NR_syscall_max __NR_get_bcstat
#include <linux/err.h>

#ifdef __NO_STUBS
--- ./kernel/sys_ni.c.ve3 2006-07-10 12:39:20.000000000 +0400
+++ ./kernel/sys_ni.c 2006-08-21 14:12:49.000000000 +0400
@@ -134,3 +134,9 @@ cond_syscall(sys_madvise);
cond_syscall(sys_mremap);
cond_syscall(sys_remap_file_pages);
cond_syscall(compat_sys_move_pages);
+
+/* user resources syscalls */
+cond_syscall(sys_set_bcid);
+cond_syscall(sys_get_bcid);
+cond_syscall(sys_set_bclimit);
+cond_syscall(sys_get_bcstat);
--- ./kernel/bc/Makefile.ve3 2006-08-21 13:49:49.000000000 +0400
+++ ./kernel/bc/Makefile 2006-08-21 13:55:39.000000000 +0400
@@ -6,3 +6,4 @@

```

```

obj-$(CONFIG_BEANCOUNTERS) += beancounter.o
obj-$(CONFIG_BEANCOUNTERS) += misc.o
+obj-$(CONFIG_BEANCOUNTERS) += sys.o
--- ./kernel/bc/sys.c.ve3 2006-08-21 13:49:49.000000000 +0400
+++ ./kernel/bc/sys.c 2006-08-21 14:43:04.000000000 +0400
@@ -0,0 +1,120 @@
+/*
+ * kernel/bc/sys.c
+ *
+ * Copyright (C) 2006 OpenVZ. SWsoft Inc
+ *
+ */
+
+#include <linux/sched.h>
+#include <asm/uaccess.h>
+
+#include <bc/beancounter.h>
+#include <bc/task.h>
+
+asmlinkage long sys_get_bcid(void)
+{
+ struct beancounter *bc;
+
+ bc = get_exec_bc();
+ return bc->bc_id;
+}
+
+asmlinkage long sys_set_bcid(bcid_t id)
+{
+ int error;
+ struct beancounter *bc;
+ struct task_beancounter *task_bc;
+
+ task_bc = &current->task_bc;
+
+ /* You may only set an bc as root */
+ error = -EPERM;
+ if (!capable(CAP_SETUID))
+ goto out;
+
+ /* Ok - set up a beancounter entry for this user */
+ error = -ENOMEM;
+ bc = beancounter_findcreate(id, BC_ALLOC);
+ if (bc == NULL)
+ goto out;
+
+ /* install bc */
+ put_beancounter(task_bc->exec_bc);

```

```

+ task_bc->exec_bc = bc;
+ put_beancounter(task_bc->fork_bc);
+ task_bc->fork_bc = get_beancounter(bc);
+ error = 0;
+out:
+ return error;
+}
+
+asmlinkage long sys_set_bclimit(bcid_t id, unsigned long resource,
+ unsigned long __user *limits)
+{
+ int error;
+ unsigned long flags;
+ struct beancounter *bc;
+ unsigned long new_limits[2];
+
+ error = -EPERM;
+ if(!capable(CAP_SYS_RESOURCE))
+ goto out;
+
+ error = -EINVAL;
+ if (resource >= BC_RESOURCES)
+ goto out;
+
+ error = -EFAULT;
+ if (copy_from_user(&new_limits, limits, sizeof(new_limits)))
+ goto out;
+
+ error = -EINVAL;
+ if (new_limits[0] > BC_MAXVALUE || new_limits[1] > BC_MAXVALUE ||
+ new_limits[0] > new_limits[1])
+ goto out;
+
+ error = -ENOENT;
+ bc = beancounter_findcreate(id, BC_LOOKUP);
+ if (bc == NULL)
+ goto out;
+
+ spin_lock_irqsave(&bc->bc_lock, flags);
+ bc->bc_parms[resource].barrier = new_limits[0];
+ bc->bc_parms[resource].limit = new_limits[1];
+ spin_unlock_irqrestore(&bc->bc_lock, flags);
+
+ put_beancounter(bc);
+ error = 0;
+out:
+ return error;
+}

```

```

+
+int sys_get_bcstat(bc_id_t id, unsigned long resource,
+ struct bc_resource_parm __user *uparm)
+{
+ int error;
+ unsigned long flags;
+ struct beancounter *bc;
+ struct bc_resource_parm parm;
+
+ error = -EINVAL;
+ if (resource >= BC_RESOURCES)
+ goto out;
+
+ error = -ENOENT;
+ bc = beancounter_findcreate(id, BC_LOOKUP);
+ if (bc == NULL)
+ goto out;
+
+ spin_lock_irqsave(&bc->bc_lock, flags);
+ parm = bc->bc_parms[resource];
+ spin_unlock_irqrestore(&bc->bc_lock, flags);
+ put_beancounter(bc);
+
+ error = 0;
+ if (copy_to_user(uparm, &parm, sizeof(parm)))
+ error = -EFAULT;
+
+out:
+ return error;
+}

```

---

Subject: [PATCH 6/7] BC: kernel memory (core)  
 Posted by [dev](#) on Tue, 29 Aug 2006 14:55:19 GMT  
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---

Introduce BC\_KMEMSIZE resource which accounts kernel objects allocated by task's request.

Reference to BC is kept on struct page or slab object. For slabs each struct slab contains a set of pointers corresponding objects are charged to.

Allocation charge rules:

1. Pages - if allocation is performed with \_\_GFP\_BC flag - page is charged to current's exec\_bc.
2. Slabs - kmem\_cache may be created with SLAB\_BC flag - in this case each allocation is charged. Caches used by kmalloc are

created with SLAB\_BC | SLAB\_BC\_NOCHARGE flags. In this case only \_\_GFP\_BC allocations are charged.

Signed-off-by: Pavel Emelianov <xemul@sw.ru>

Signed-off-by: Kirill Korotaev <dev@sw.ru>

---

```
include/bc/beancounter.h | 4 +
include/bc/kmem.h        | 46 ++++++
include/linux/gfp.h     | 8 +-
include/linux/mm.h      | 6 ++
include/linux/slab.h    | 4 +
include/linux/vmalloc.h | 1
kernel/bc/Makefile      | 1
kernel/bc/beancounter.c | 3 +
kernel/bc/kmem.c        | 85 ++++++
mm/mempool.c            | 2
mm/page_alloc.c         | 11 +++++
mm/slab.c                | 121 ++++++
mm/vmalloc.c            | 6 ++
13 files changed, 273 insertions(+), 25 deletions(-)
```

--- ./include/bc/beancounter.h.bckmem 2006-08-28 12:47:52.000000000 +0400

+++ ./include/bc/beancounter.h 2006-08-28 12:59:28.000000000 +0400

@@ -12,7 +12,9 @@

\* Resource list.

\*/

+#define BC\_RESOURCES 0

+#define BC\_KMEMSIZE 0

+

+#define BC\_RESOURCES 1

```
struct bc_resource_parm {
    unsigned long barrier; /* A barrier over which resource allocations
```

--- /dev/null 2006-07-18 14:52:43.075228448 +0400

+++ ./include/bc/kmem.h 2006-08-28 13:00:43.000000000 +0400

@@ -0,0 +1,46 @@

+/\*

+ \* include/bc/kmem.h

+ \*

+ \* Copyright (C) 2006 OpenVZ. SWsoft Inc

+ \*

+ \*/

+

+#ifndef \_\_BC\_KMEM\_H\_

+#define \_\_BC\_KMEM\_H\_



```

+
+/*
+ * BC_KMEMSIZE accounting
+ */
+
+struct mm_struct;
+struct page;
+struct beancounter;
+
+#ifdef CONFIG_BEANCOUNTERS
+int __must_check bc_page_charge(struct page *page, int order, gfp_t flags);
+void bc_page_uncharge(struct page *page, int order);
+
+int __must_check bc_slab_charge(kmem_cache_t *cachep, void *obj, gfp_t flags);
+void bc_slab_uncharge(kmem_cache_t *cachep, void *obj);
+#else
+static inline int __must_check bc_page_charge(struct page *page,
+ int order, gfp_t flags)
+{
+ return 0;
+}
+
+static inline void bc_page_uncharge(struct page *page, int order)
+{
+}
+
+static inline int __must_check bc_slab_charge(kmem_cache_t *cachep,
+ void *obj, gfp_t flags)
+{
+ return 0;
+}
+
+static inline void bc_slab_uncharge(kmem_cache_t *cachep, void *obj)
+{
+}
+#endif
+#endif /* __BC_SLAB_H */
--- ./include/linux/gfp.h.bckmem 2006-08-28 12:20:13.000000000 +0400
+++ ./include/linux/gfp.h 2006-08-28 12:59:28.000000000 +0400
@@ -46,15 +46,18 @@ struct vm_area_struct;
#define __GFP_NOMEMALLOC ((__force gfp_t)0x10000u) /* Don't use emergency reserves */
#define __GFP_HARDWALL ((__force gfp_t)0x20000u) /* Enforce hardwall cpuset memory
allocs */
#define __GFP_THISNODE ((__force gfp_t)0x40000u)/* No fallback, no policies */
+#define __GFP_BC ((__force gfp_t)0x80000u) /* Charge allocation with BC */
+#define __GFP_BC_LIMIT ((__force gfp_t)0x100000u) /* Charge against BC limit */

-#define __GFP_BITS_SHIFT 20 /* Room for 20 __GFP_FOO bits */

```

```

+#define __GFP_BITS_SHIFT 21 /* Room for 21 __GFP_FOO bits */
#define __GFP_BITS_MASK ((__force gfp_t)((1 << __GFP_BITS_SHIFT) - 1))

/* if you forget to add the bitmask here kernel will crash, period */
#define GFP_LEVEL_MASK (__GFP_WAIT|__GFP_HIGH|__GFP_IO|__GFP_FS| \
    __GFP_COLD|__GFP_NOWARN|__GFP_REPEAT| \
    __GFP_NOFAIL|__GFP_NORETRY|__GFP_NO_GROW|__GFP_COMP| \
- __GFP_NOMEMALLOC|__GFP_HARDWALL|__GFP_THISNODE)
+ __GFP_NOMEMALLOC|__GFP_HARDWALL|__GFP_THISNODE| \
+ __GFP_BC|__GFP_BC_LIMIT)

/* This equals 0, but use constants in case they ever change */
#define GFP_NOWAIT (GFP_ATOMIC & ~__GFP_HIGH)
@@ -63,6 +66,7 @@ struct vm_area_struct;
#define GFP_NOIO (__GFP_WAIT)
#define GFP_NOFS (__GFP_WAIT | __GFP_IO)
#define GFP_KERNEL (__GFP_WAIT | __GFP_IO | __GFP_FS)
+#define GFP_KERNEL_BC (__GFP_WAIT | __GFP_IO | __GFP_FS | __GFP_BC)
#define GFP_USER (__GFP_WAIT | __GFP_IO | __GFP_FS | __GFP_HARDWALL)
#define GFP_HIGHUSER (__GFP_WAIT | __GFP_IO | __GFP_FS | __GFP_HARDWALL | \
    __GFP_HIGHMEM)
--- ./include/linux/mm.h.bckmem 2006-08-28 12:20:13.000000000 +0400
+++ ./include/linux/mm.h 2006-08-28 12:59:28.000000000 +0400
@@ -274,8 +274,14 @@ struct page {
    unsigned int gfp_mask;
    unsigned long trace[8];
#endif
+#ifdef CONFIG_BEANCOUNTERS
+ union {
+ struct beancounter *page_bc;
+ } bc;
+#endif
};

+#define page_bc(page) ((page)->bc.page_bc)
#define page_private(page) ((page)->private)
#define set_page_private(page, v) ((page)->private = (v))

--- ./include/linux/slab.h.bckmem 2006-08-28 12:20:13.000000000 +0400
+++ ./include/linux/slab.h 2006-08-28 12:59:28.000000000 +0400
@@ -46,6 +46,8 @@ typedef struct kmem_cache kmem_cache_t;
#define SLAB_PANIC 0x00040000UL /* panic if kmem_cache_create() fails */
#define SLAB_DESTROY_BY_RCU 0x00080000UL /* defer freeing pages to RCU */
#define SLAB_MEM_SPREAD 0x00100000UL /* Spread some memory over cpuset */
+#define SLAB_BC 0x00200000UL /* Account with BC */
+#define SLAB_BC_NOCHARGE 0x00400000UL /* Explicit accounting */

/* flags passed to a constructor func */

```

```

#define SLAB_CTOR_CONSTRUCTOR 0x001UL /* if not set, then deconstructor */
@@ -291,6 +293,8 @@ extern kmem_cache_t *fs_cachep;
extern kmem_cache_t *sighand_cachep;
extern kmem_cache_t *bio_cachep;

+struct beancounter;
+struct beancounter **kmem_cache_bcp(kmem_cache_t *cachep, void *obj);
#endif /* __KERNEL__ */

#endif /* _LINUX_SLAB_H */
--- ./include/linux/vmalloc.h.bckmem 2006-08-28 12:20:13.000000000 +0400
+++ ./include/linux/vmalloc.h 2006-08-28 12:59:28.000000000 +0400
@@ -36,6 +36,7 @@ struct vm_struct {
 * Highlevel APIs for driver use
 */
extern void *vmalloc(unsigned long size);
+extern void *vmalloc_bc(unsigned long size);
extern void *vmalloc_user(unsigned long size);
extern void *vmalloc_node(unsigned long size, int node);
extern void *vmalloc_exec(unsigned long size);
--- ./kernel/bc/Makefile.bckmem 2006-08-28 12:58:27.000000000 +0400
+++ ./kernel/bc/Makefile 2006-08-28 12:59:28.000000000 +0400
@@ -7,3 +7,4 @@
obj-$(CONFIG_BEANCOUNTERS) += beancounter.o
obj-$(CONFIG_BEANCOUNTERS) += misc.o
obj-$(CONFIG_BEANCOUNTERS) += sys.o
+obj-$(CONFIG_BEANCOUNTERS) += kmem.o
--- ./kernel/bc/beancounter.c.bckmem 2006-08-28 12:52:11.000000000 +0400
+++ ./kernel/bc/beancounter.c 2006-08-28 12:59:28.000000000 +0400
@@ -20,6 +20,7 @@ static void init_beancounter_struct(stru
struct beancounter init_bc;

const char *bc_rnames[] = {
+ "kmemsize", /* 0 */
};

static struct hlist_head bc_hash[BC_HASH_SIZE];
@@ -221,6 +222,8 @@ static void init_beancounter_syslimits(s
{
int k;

+ bc->bc_parms[BC_KMEMSIZE].limit = 32 * 1024 * 1024;
+
for (k = 0; k < BC_RESOURCES; k++)
bc->bc_parms[k].barrier = bc->bc_parms[k].limit;
}
--- /dev/null 2006-07-18 14:52:43.075228448 +0400
+++ ./kernel/bc/kmem.c 2006-08-28 12:59:28.000000000 +0400

```

```

@@ -0,0 +1,85 @@
+/*
+ * kernel/bc/kmem.c
+ *
+ * Copyright (C) 2006 OpenVZ. SWsoft Inc
+ *
+ */
+
+#include <linux/sched.h>
+#include <linux/gfp.h>
+#include <linux/slab.h>
+#include <linux/mm.h>
+
+#include <bc/beancounter.h>
+#include <bc/kmem.h>
+#include <bc/task.h>
+
+/*
+ * Slab accounting
+ */
+
+int bc_slab_charge(kmem_cache_t *cachep, void *objp, gfp_t flags)
+{
+ unsigned int size;
+ struct beancounter *bc, **slab_bcp;
+
+ bc = get_exec_bc();
+
+ size = kmem_cache_size(cachep);
+ if (bc_charge(bc, BC_KMEMSIZE, size,
+ (flags & __GFP_BC_LIMIT ? BC_LIMIT : BC_BARRIER)))
+ return -ENOMEM;
+
+ slab_bcp = kmem_cache_bcp(cachep, objp);
+ *slab_bcp = get_beancounter(bc);
+ return 0;
+}
+
+void bc_slab_uncharge(kmem_cache_t *cachep, void *objp)
+{
+ unsigned int size;
+ struct beancounter *bc, **slab_bcp;
+
+ slab_bcp = kmem_cache_bcp(cachep, objp);
+ if (*slab_bcp == NULL)
+ return;
+
+ bc = *slab_bcp;

```

```

+ size = kmem_cache_size(cache);
+ bc_uncharge(bc, BC_KMEMSIZE, size);
+ put_beancounter(bc);
+ *slab_bcp = NULL;
+}
+
+/*
+ * Pages accounting
+ */
+
+int bc_page_charge(struct page *page, int order, gfp_t flags)
+{
+ struct beancounter *bc;
+
+ BUG_ON(page_bc(page) != NULL);
+
+ bc = get_exec_bc();
+
+ if (bc_charge(bc, BC_KMEMSIZE, PAGE_SIZE << order,
+ (flags & __GFP_BC_LIMIT ? BC_LIMIT : BC_BARRIER)))
+ return -ENOMEM;
+
+ page_bc(page) = get_beancounter(bc);
+ return 0;
+}
+
+void bc_page_uncharge(struct page *page, int order)
+{
+ struct beancounter *bc;
+
+ bc = page_bc(page);
+ if (bc == NULL)
+ return;
+
+ bc_uncharge(bc, BC_KMEMSIZE, PAGE_SIZE << order);
+ put_beancounter(bc);
+ page_bc(page) = NULL;
+}
--- ./mm/mempool.c.bckmem 2006-04-21 11:59:36.000000000 +0400
+++ ./mm/mempool.c 2006-08-28 12:59:28.000000000 +0400
@@ -119,6 +119,7 @@ int mempool_resize(mempool_t *pool, int
    unsigned long flags;

    BUG_ON(new_min_nr <= 0);
+ gfp_mask &= ~__GFP_BC;

    spin_lock_irqsave(&pool->lock, flags);
    if (new_min_nr <= pool->min_nr) {

```

```

@@ -212,6 +213,7 @@ void * mempool_alloc(mempool_t *pool, gf
    gfp_mask |= __GFP_NOMEMALLOC; /* don't allocate emergency reserves */
    gfp_mask |= __GFP_NORETRY; /* don't loop in __alloc_pages */
    gfp_mask |= __GFP_NOWARN; /* failures are OK */
+ gfp_mask &= ~__GFP_BC; /* do not charge */

```

```

    gfp_temp = gfp_mask & ~(__GFP_WAIT|__GFP_IO);

```

```

--- ./mm/page_alloc.c.bckmem 2006-08-28 12:20:13.000000000 +0400

```

```

+++ ./mm/page_alloc.c 2006-08-28 12:59:28.000000000 +0400

```

```

@@ -40,6 +40,8 @@

```

```

#include <linux/sort.h>

```

```

#include <linux/pfn.h>

```

```

+#include <bc/kmem.h>

```

```

+

```

```

#include <asm/tlbflush.h>

```

```

#include <asm/div64.h>

```

```

#include "internal.h"

```

```

@@ -516,6 +518,8 @@ static void __free_pages_ok(struct page
    if (reserved)
        return;

```

```

+ bc_page_uncharge(page, order);

```

```

+

```

```

    kernel_map_pages(page, 1 << order, 0);

```

```

    local_irq_save(flags);

```

```

    __count_vm_events(PGFREE, 1 << order);

```

```

@@ -799,6 +803,8 @@ static void fastcall free_hot_cold_page(
    if (free_pages_check(page))
        return;

```

```

+ bc_page_uncharge(page, 0);

```

```

+

```

```

    kernel_map_pages(page, 1, 0);

```

```

    pcp = &zone_pcp(zone, get_cpu())->pcp[cold];

```

```

@@ -1188,6 +1194,11 @@ nopage:

```

```

    show_mem();

```

```

}

```

```

got_pg:

```

```

+ if ((gfp_mask & __GFP_BC) &&

```

```

+ bc_page_charge(page, order, gfp_mask)) {

```

```

+ __free_pages(page, order);

```

```

+ page = NULL;

```

```

+ }

```

```

#ifdef CONFIG_PAGE_OWNER

```

```

    if (page)

```

```

    set_page_owner(page, order, gfp_mask);
--- ./mm/slab.c.bckmem 2006-08-28 12:20:13.000000000 +0400
+++ ./mm/slab.c 2006-08-28 12:59:28.000000000 +0400
@@ -108,6 +108,8 @@
#include <linux/mutex.h>
#include <linux/rtmutex.h>

+#include <bc/kmem.h>
+
#include <asm/uaccess.h>
#include <asm/cacheflush.h>
#include <asm/tlbflush.h>
@@ -175,11 +177,13 @@
    SLAB_CACHE_DMA | \
    SLAB_MUST_HWCACHE_ALIGN | SLAB_STORE_USER | \
    SLAB_RECLAIM_ACCOUNT | SLAB_PANIC | \
+   SLAB_BC | SLAB_BC_NOCHARGE | \
    SLAB_DESTROY_BY_RCU | SLAB_MEM_SPREAD)
#else
# define CREATE_MASK (SLAB_HWCACHE_ALIGN | \
    SLAB_CACHE_DMA | SLAB_MUST_HWCACHE_ALIGN | \
    SLAB_RECLAIM_ACCOUNT | SLAB_PANIC | \
+   SLAB_BC | SLAB_BC_NOCHARGE | \
    SLAB_DESTROY_BY_RCU | SLAB_MEM_SPREAD)
#endif

@@ -793,9 +797,33 @@ static struct kmem_cache *kmem_find_gene
return __find_general_cachep(size, gfpflags);
}

-static size_t slab_mgmt_size(size_t nr_objs, size_t align)
+static size_t slab_mgmt_size_raw(size_t nr_objs)
{
- return ALIGN(sizeof(struct slab)+nr_objs*sizeof(kmem_bufctl_t), align);
+ return sizeof(struct slab) + nr_objs * sizeof(kmem_bufctl_t);
+}
+
+#ifdef CONFIG_BEANCOUNTERS
+#define BC_EXTRASIZE sizeof(struct beancounter *)
+static inline size_t slab_mgmt_size_noalign(int flags, size_t nr_objs)
+{
+ size_t size;
+
+ size = slab_mgmt_size_raw(nr_objs);
+ if (flags & SLAB_BC)
+ size = ALIGN(size, BC_EXTRASIZE) + nr_objs * BC_EXTRASIZE;
+ return size;
+}

```

```

+#else
+#define BC_EXTRASIZE 0
+static inline size_t slab_mgmt_size_noalign(int flags, size_t nr_objs)
+{
+ return slab_mgmt_size_raw(nr_objs);
+}
+#endif
+
+static inline size_t slab_mgmt_size(int flags, size_t nr_objs, size_t align)
+{
+ return ALIGN(slab_mgmt_size_noalign(flags, nr_objs), align);
+}

/*
@@ -840,20 +868,21 @@ static void cache_estimate(unsigned long
 * into account.
 */
nr_objs = (slab_size - sizeof(struct slab)) /
- (buffer_size + sizeof(kmem_bufctl_t));
+ (buffer_size + sizeof(kmem_bufctl_t) +
+ (flags & SLAB_BC ? BC_EXTRASIZE : 0));

/*
 * This calculated number will be either the right
 * amount, or one greater than what we want.
 */
- if (slab_mgmt_size(nr_objs, align) + nr_objs*buffer_size
+ if (slab_mgmt_size(flags, nr_objs, align) + nr_objs*buffer_size
    > slab_size)
nr_objs--;

if (nr_objs > SLAB_LIMIT)
nr_objs = SLAB_LIMIT;

- mgmt_size = slab_mgmt_size(nr_objs, align);
+ mgmt_size = slab_mgmt_size(flags, nr_objs, align);
}
*num = nr_objs;
*left_over = slab_size - nr_objs*buffer_size - mgmt_size;
@@ -1412,7 +1441,8 @@ void __init kmem_cache_init(void)
sizes[INDEX_AC].cs_cachep = kmem_cache_create(names[INDEX_AC].name,
    sizes[INDEX_AC].cs_size,
    ARCH_KMALLOC_MINALIGN,
- ARCH_KMALLOC_FLAGS|SLAB_PANIC,
+ ARCH_KMALLOC_FLAGS | SLAB_BC |
+ SLAB_BC_NOCHARGE | SLAB_PANIC,
    NULL, NULL);

```



```

if (INDEX_AC != INDEX_L3) {
@@ -1420,7 +1450,8 @@ void __init kmem_cache_init(void)
    kmem_cache_create(names[INDEX_L3].name,
        sizes[INDEX_L3].cs_size,
        ARCH_KMALLOC_MINALIGN,
-   ARCH_KMALLOC_FLAGS|SLAB_PANIC,
+   ARCH_KMALLOC_FLAGS | SLAB_BC |
+   SLAB_BC_NOCHARGE | SLAB_PANIC,
        NULL, NULL);
}

@@ -1438,7 +1469,8 @@ void __init kmem_cache_init(void)
    sizes->cs_cachep = kmem_cache_create(names->name,
        sizes->cs_size,
        ARCH_KMALLOC_MINALIGN,
-   ARCH_KMALLOC_FLAGS|SLAB_PANIC,
+   ARCH_KMALLOC_FLAGS | SLAB_BC |
+   SLAB_BC_NOCHARGE | SLAB_PANIC,
        NULL, NULL);
}

@@ -1941,7 +1973,8 @@ static size_t calculate_slab_order(struct
    * looping condition in cache_grow().
    */
    offslab_limit = size - sizeof(struct slab);
-   offslab_limit /= sizeof(kmem_bufctl_t);
+   offslab_limit /= (sizeof(kmem_bufctl_t) +
+   (flags & SLAB_BC ? BC_EXTRASIZE : 0));

    if (num > offslab_limit)
        break;
@@ -2249,8 +2282,8 @@ kmem_cache_create (const char *name, siz
    cachep = NULL;
    goto oops;
}
- slab_size = ALIGN(cachep->num * sizeof(kmem_bufctl_t)
-   + sizeof(struct slab), align);
+
+ slab_size = slab_mgmt_size(flags, cachep->num, align);

/*
    * If the slab has been placed off-slab, and we have enough space then
@@ -2261,11 +2294,9 @@ kmem_cache_create (const char *name, siz
    left_over -= slab_size;
}

- if (flags & CFLGS_OFF_SLAB) {
+ if (flags & CFLGS_OFF_SLAB)

```



```

} else {
@@ -2540,14 +2596,14 @@ static struct slab *alloc_slabmgmt(struct
    slabp->colouroff = colour_off;
    slabp->s_mem = objp + colour_off;
    slabp->nodeid = nodeid;
+#ifdef CONFIG_BEANCOUNTERS
+ if (cachep->flags & SLAB_BC)
+ memset(slab_bc_ptrs(cachep, slabp), 0,
+   cachep->num * BC_EXTRASIZE);
+#endif
    return slabp;
}

-static inline kmem_bufctl_t *slab_bufctl(struct slab *slabp)
-{-
- return (kmem_bufctl_t *) (slabp + 1);
-}
-
static void cache_init_objs(struct kmem_cache *cachep,
    struct slab *slabp, unsigned long ctor_flags)
{
@@ -2725,7 +2781,7 @@ static int cache_grow(struct kmem_cache
    * Get mem for the objs. Attempt to allocate a physical page from
    * 'nodeid'.
    */
- objp = kmem_getpages(cachep, flags, nodeid);
+ objp = kmem_getpages(cachep, flags & (~__GFP_BC), nodeid);
    if (!objp)
        goto failed;

@@ -3073,6 +3129,19 @@ static inline void *___cache_alloc(stru
    return objp;
}

+static inline int bc_should_charge(kmem_cache_t *cachep, gfp_t flags)
+{-
+ #ifdef CONFIG_BEANCOUNTERS
+ if (!(cachep->flags & SLAB_BC))
+   return 0;
+ if (flags & __GFP_BC)
+   return 1;
+ if (!(cachep->flags & SLAB_BC_NOCHARGE))
+   return 1;
+ #endif
+ return 0;
+}
+
static __always_inline void *__cache_alloc(struct kmem_cache *cachep,

```

```

    gfp_t flags, void *caller)
{
@@ -3086,6 +3155,12 @@ static __always_inline void *__cache_all
    local_irq_restore(save_flags);
    objp = cache_alloc_debugcheck_after(cachep, flags, objp,
        caller);
+
+ if (objp && bc_should_charge(cachep, flags))
+ if (bc_slab_charge(cachep, objp, flags)) {
+ kmem_cache_free(cachep, objp);
+ objp = NULL;
+ }
    prefetchw(objp);
    return objp;
}
@@ -3283,6 +3358,8 @@ static inline void __cache_free(struct k
    struct array_cache *ac = cpu_cache_get(cachep);

    check_irq_off();
+ if (cachep->flags & SLAB_BC)
+ bc_slab_uncharge(cachep, objp);
    objp = cache_free_debugcheck(cachep, objp, __builtin_return_address(0));

    if (cache_free_alien(cachep, objp))
--- ./mm/vmalloc.c.bckmem 2006-08-28 12:20:13.000000000 +0400
+++ ./mm/vmalloc.c 2006-08-28 12:59:28.000000000 +0400
@@ -520,6 +520,12 @@ void *vmalloc(unsigned long size)
}
EXPORT_SYMBOL(vmalloc);

+void *vmalloc_bc(unsigned long size)
+{
+ return __vmalloc(size, GFP_KERNEL_BC | __GFP_HIGHMEM, PAGE_KERNEL);
+}
+EXPORT_SYMBOL(vmalloc_bc);
+
+/**
+ * vmalloc_user - allocate virtually contiguous memory which has
+ *   been zeroed so it can be mapped to userspace without

```

---

Subject: [PATCH 7/7] BC: kernel memory (marks)  
 Posted by [dev](#) on Tue, 29 Aug 2006 14:56:01 GMT  
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---

Mark some kmem caches with SLAB\_BC and some allocations with \_\_GFP\_BC to cause charging/limiting of appropriate kernel resources.

Signed-off-by: Pavel Emelianov <xemul@sw.ru>

Signed-off-by: Kirill Korotaev <dev@sw.ru>

---

```
arch/i386/kernel/ldt.c      | 4 +++
arch/i386/mm/init.c        | 4 +++
arch/i386/mm/pgtable.c     | 6 +++++
drivers/char/tty_io.c      | 10 +++++-----
fs/file.c                  | 8 +++++-----
fs/locks.c                 | 2 +-
fs/namespace.c            | 3 +-
fs/select.c                | 7 +++++---
include/asm-i386/thread_info.h | 4 +-
include/asm-ia64/pgalloc.h | 24 ++++++-----
include/asm-x86_64/pgalloc.h | 12 ++++++-----
include/asm-x86_64/thread_info.h | 5 +-
ipc/msgutil.c             | 4 +-
ipc/sem.c                  | 7 +++++---
ipc/util.c                 | 8 +++++---
kernel/fork.c              | 15 ++++++-----
kernel/posix-timers.c     | 3 +-
kernel/signal.c           | 2 +-
kernel/user.c              | 2 +-
mm/rmap.c                  | 3 +-
mm/shmem.c                 | 3 +-
21 files changed, 80 insertions(+), 56 deletions(-)
```

--- ./arch/i386/kernel/ldt.c.bckmemc 2006-08-28 12:20:10.000000000 +0400

+++ ./arch/i386/kernel/ldt.c 2006-08-28 13:05:46.000000000 +0400

```
@@ -39,9 +39,9 @@ static int alloc_ldt(mm_context_t *pc, i
    oldsize = pc->size;
    mincount = (mincount+511)&(~511);
    if (mincount*LDT_ENTRY_SIZE > PAGE_SIZE)
-   newldt = vmalloc(mincount*LDT_ENTRY_SIZE);
+   newldt = vmalloc_bc(mincount*LDT_ENTRY_SIZE);
    else
-   newldt = kmalloc(mincount*LDT_ENTRY_SIZE, GFP_KERNEL);
+   newldt = kmalloc(mincount*LDT_ENTRY_SIZE, GFP_KERNEL_BC);
```

```
if (!newldt)
    return -ENOMEM;
```

--- ./arch/i386/mm/init.c.bckmemc 2006-08-28 12:20:10.000000000 +0400

+++ ./arch/i386/mm/init.c 2006-08-28 13:05:46.000000000 +0400

```
@@ -709,7 +709,7 @@ void __init pgtable_cache_init(void)
    pmd_cache = kmem_cache_create("pmd",
        PTRS_PER_PMD*sizeof(pmd_t),
```

```

PTRS_PER_PMD*sizeof(pmd_t),
- 0,
+ SLAB_BC,
  pmd_ctor,
  NULL);
if (!pmd_cache)
@@ -718,7 +718,7 @@ void __init pgtable_cache_init(void)
  pgd_cache = kmem_cache_create("pgd",
    PTRS_PER_PGD*sizeof(pgd_t),
    PTRS_PER_PGD*sizeof(pgd_t),
- 0,
+ SLAB_BC,
  pgd_ctor,
  PTRS_PER_PMD == 1 ? pgd_dtor : NULL);
if (!pgd_cache)
--- ./arch/i386/mm/pgtable.c.bckmemc 2006-08-28 12:20:10.000000000 +0400
+++ ./arch/i386/mm/pgtable.c 2006-08-28 13:05:46.000000000 +0400
@@ -186,9 +186,11 @@ struct page *pte_alloc_one(struct mm_str
  struct page *pte;

#ifdef CONFIG_HIGHPTE
- pte = alloc_pages(GFP_KERNEL|__GFP_HIGHMEM|__GFP_REPEAT|__GFP_ZERO, 0);
+ pte = alloc_pages(GFP_KERNEL|__GFP_HIGHMEM|__GFP_REPEAT|__GFP_ZERO |
+ __GFP_BC | __GFP_BC_LIMIT, 0);
#else
- pte = alloc_pages(GFP_KERNEL|__GFP_REPEAT|__GFP_ZERO, 0);
+ pte = alloc_pages(GFP_KERNEL|__GFP_REPEAT|__GFP_ZERO|
+ __GFP_BC | __GFP_BC_LIMIT, 0);
#endif
  return pte;
}
--- ./drivers/char/tty_io.c.bckmemc 2006-08-28 12:20:11.000000000 +0400
+++ ./drivers/char/tty_io.c 2006-08-28 13:05:46.000000000 +0400
@@ -165,7 +165,7 @@ static void release_mem(struct tty_struct

static struct tty_struct *alloc_tty_struct(void)
{
- return kzalloc(sizeof(struct tty_struct), GFP_KERNEL);
+ return kzalloc(sizeof(struct tty_struct), GFP_KERNEL_BC);
}

static void tty_buffer_free_all(struct tty_struct *);
@@ -1904,7 +1904,7 @@ static int init_dev(struct tty_driver *d

if (!*tp_loc) {
  tp = (struct termios *) kmalloc(sizeof(struct termios),
- GFP_KERNEL);
+ GFP_KERNEL_BC);

```

```

if (!ltp)
    goto free_mem_out;
*tp = driver->init_termios;
@@ -1912,7 +1912,7 @@ static int init_dev(struct tty_driver *d

if (!*ltp_loc) {
    ltp = (struct termios *) kmalloc(sizeof(struct termios),
-    GFP_KERNEL);
+    GFP_KERNEL_BC);
    if (!ltp)
        goto free_mem_out;
    memset(ltp, 0, sizeof(struct termios));
@@ -1937,7 +1937,7 @@ static int init_dev(struct tty_driver *d

if (!*o_tp_loc) {
    o_tp = (struct termios *)
-    kmalloc(sizeof(struct termios), GFP_KERNEL);
+    kmalloc(sizeof(struct termios), GFP_KERNEL_BC);
    if (!o_tp)
        goto free_mem_out;
    *o_tp = driver->other->init_termios;
@@ -1945,7 +1945,7 @@ static int init_dev(struct tty_driver *d

if (!*o_ltp_loc) {
    o_ltp = (struct termios *)
-    kmalloc(sizeof(struct termios), GFP_KERNEL);
+    kmalloc(sizeof(struct termios), GFP_KERNEL_BC);
    if (!o_ltp)
        goto free_mem_out;
    memset(o_ltp, 0, sizeof(struct termios));
--- ./fs/file.c.bckmemc 2006-08-28 12:20:12.000000000 +0400
+++ ./fs/file.c 2006-08-28 13:05:46.000000000 +0400
@@ -44,9 +44,9 @@ struct file ** alloc_fd_array(int num)
    int size = num * sizeof(struct file *);

if (size <= PAGE_SIZE)
- new_fds = (struct file **) kmalloc(size, GFP_KERNEL);
+ new_fds = (struct file **) kmalloc(size, GFP_KERNEL_BC);
else
- new_fds = (struct file **) vmalloc(size);
+ new_fds = (struct file **) vmalloc_bc(size);
    return new_fds;
}

@@ -213,9 +213,9 @@ fd_set * alloc_fdset(int num)
    int size = num / 8;

if (size <= PAGE_SIZE)

```

```

- new_fdset = (fd_set *) kmalloc(size, GFP_KERNEL);
+ new_fdset = (fd_set *) kmalloc(size, GFP_KERNEL_BC);
  else
- new_fdset = (fd_set *) vmalloc(size);
+ new_fdset = (fd_set *) vmalloc_bc(size);
  return new_fdset;
}

--- ./fs/locks.c.bckmemc 2006-08-28 12:20:12.000000000 +0400
+++ ./fs/locks.c 2006-08-28 13:05:46.000000000 +0400
@@ -2228,7 +2228,7 @@ EXPORT_SYMBOL(lock_may_write);
static int __init filelock_init(void)
{
  filelock_cache = kmem_cache_create("file_lock_cache",
- sizeof(struct file_lock), 0, SLAB_PANIC,
+ sizeof(struct file_lock), 0, SLAB_PANIC | SLAB_BC,
  init_once, NULL);
  return 0;
}

--- ./fs/namespace.c.bckmemc 2006-08-28 12:20:12.000000000 +0400
+++ ./fs/namespace.c 2006-08-28 13:05:46.000000000 +0400
@@ -1813,7 +1813,8 @@ void __init mnt_init(unsigned long mempa
  init_rwsem(&namespace_sem);

  mnt_cache = kmem_cache_create("mnt_cache", sizeof(struct vfsmount),
- 0, SLAB_HWCACHE_ALIGN | SLAB_PANIC, NULL, NULL);
+ 0, SLAB_HWCACHE_ALIGN | SLAB_BC | SLAB_PANIC,
+ NULL, NULL);

  mount_hashtable = (struct list_head *)__get_free_page(GFP_ATOMIC);

--- ./fs/select.c.bckmemc 2006-08-28 12:20:12.000000000 +0400
+++ ./fs/select.c 2006-08-28 13:05:46.000000000 +0400
@@ -103,7 +103,8 @@ static struct poll_table_entry *poll_get
  if (!table || POLL_TABLE_FULL(table)) {
    struct poll_table_page *new_table;

- new_table = (struct poll_table_page *) __get_free_page(GFP_KERNEL);
+ new_table = (struct poll_table_page *)
+ __get_free_page(GFP_KERNEL_BC);
    if (!new_table) {
      p->error = -ENOMEM;
      __set_current_state(TASK_RUNNING);
@@ -339,7 +340,7 @@ static int core_sys_select(int n, fd_set
  if (size > sizeof(stack_fds) / 6) {
    /* Not enough space in on-stack array; must use kmalloc */
    ret = -ENOMEM;
- bits = kmalloc(6 * size, GFP_KERNEL);

```



```

+ bits = kmalloc(6 * size, GFP_KERNEL_BC);
  if (!bits)
    goto out_nofds;
}
@@ -693,7 +694,7 @@ int do_sys_poll(struct pollfd __user *uf
  if (!stack_pp)
    stack_pp = pp = (struct poll_list *)stack_pps;
  else {
- pp = kmalloc(size, GFP_KERNEL);
+ pp = kmalloc(size, GFP_KERNEL_BC);
  if (!pp)
    goto out_fds;
}
--- ./include/asm-i386/thread_info.h.bckmemc 2006-07-10 12:39:19.000000000 +0400
+++ ./include/asm-i386/thread_info.h 2006-08-28 13:05:46.000000000 +0400
@@ -99,13 +99,13 @@ static inline struct thread_info *curren
({
  \
  struct thread_info *ret; \
  \
- ret = kmalloc(THREAD_SIZE, GFP_KERNEL); \
+ ret = kmalloc(THREAD_SIZE, GFP_KERNEL_BC); \
  if (ret) \
    memset(ret, 0, THREAD_SIZE); \
  ret; \
})
#else
-#define alloc_thread_info(tsk) kmalloc(THREAD_SIZE, GFP_KERNEL)
+#define alloc_thread_info(tsk) kmalloc(THREAD_SIZE, GFP_KERNEL_BC)
#endif

#define free_thread_info(info) kfree(info)
--- ./include/asm-ia64/pgalloc.h.bckmemc 2006-07-10 12:39:19.000000000 +0400
+++ ./include/asm-ia64/pgalloc.h 2006-08-28 13:05:46.000000000 +0400
@@ -19,6 +19,8 @@
#include <linux/page-flags.h>
#include <linux/threads.h>

+#include <bc/kmem.h>
+
#include <asm/mmu_context.h>

DECLARE_PER_CPU(unsigned long *, __pgtable_quicklist);
@@ -37,7 +39,7 @@ static inline long pgtable_quicklist_tot
  return ql_size;
}

-static inline void *pgtable_quicklist_alloc(void)
+static inline void *pgtable_quicklist_alloc(int charge)

```

```

{
    unsigned long *ret = NULL;

@@ -45,13 +47,20 @@ static inline void *pgtable_quicklist_al

    ret = pgtable_quicklist;
    if (likely(ret != NULL)) {
+ if (charge && bc_page_charge(virt_to_page(ret),
+ 0, __GFP_BC_LIMIT)) {
+ ret = NULL;
+ goto out;
+ }
    pgtable_quicklist = (unsigned long *)(*ret);
    ret[0] = 0;
    --pgtable_quicklist_size;
+out:
    preempt_enable();
    } else {
    preempt_enable();
- ret = (unsigned long *)__get_free_page(GFP_KERNEL | __GFP_ZERO);
+ ret = (unsigned long *)__get_free_page(GFP_KERNEL |
+ __GFP_ZERO | __GFP_BC | __GFP_BC_LIMIT);
    }

    return ret;
@@ -69,6 +78,7 @@ static inline void pgtable_quicklist_fre
#endif

    preempt_disable();
+ bc_page_uncharge(virt_to_page(pgtable_entry), 0);
    *(unsigned long *)pgtable_entry = (unsigned long)pgtable_quicklist;
    pgtable_quicklist = (unsigned long *)pgtable_entry;
    ++pgtable_quicklist_size;
@@ -77,7 +87,7 @@ static inline void pgtable_quicklist_fre

static inline pgd_t *pgd_alloc(struct mm_struct *mm)
{
- return pgtable_quicklist_alloc();
+ return pgtable_quicklist_alloc(1);
}

static inline void pgd_free(pgd_t *pgd)
@@ -94,7 +104,7 @@ pgd_populate(struct mm_struct *mm, pgd_t

static inline pud_t *pud_alloc_one(struct mm_struct *mm, unsigned long addr)
{
- return pgtable_quicklist_alloc();
+ return pgtable_quicklist_alloc(1);
}

```

```

}

static inline void pud_free(pud_t * pud)
@@ -112,7 +122,7 @@ pud_populate(struct mm_struct *mm, pud_t

static inline pmd_t *pmd_alloc_one(struct mm_struct *mm, unsigned long addr)
{
- return pgtable_quicklist_alloc();
+ return pgtable_quicklist_alloc(1);
}

static inline void pmd_free(pmd_t * pmd)
@@ -137,13 +147,13 @@ pmd_populate_kernel(struct mm_struct *mm
static inline struct page *pte_alloc_one(struct mm_struct *mm,
    unsigned long addr)
{
- return virt_to_page(pgtable_quicklist_alloc());
+ return virt_to_page(pgtable_quicklist_alloc(1));
}

static inline pte_t *pte_alloc_one_kernel(struct mm_struct *mm,
    unsigned long addr)
{
- return pgtable_quicklist_alloc();
+ return pgtable_quicklist_alloc(0);
}

static inline void pte_free(struct page *pte)
--- ./include/asm-x86_64/pgalloc.h.bckmemc 2006-04-21 11:59:36.000000000 +0400
+++ ./include/asm-x86_64/pgalloc.h 2006-08-28 13:05:46.000000000 +0400
@@ -31,12 +31,14 @@ static inline void pmd_free(pmd_t *pmd)

static inline pmd_t *pmd_alloc_one (struct mm_struct *mm, unsigned long addr)
{
- return (pmd_t *)get_zeroed_page(GFP_KERNEL|__GFP_REPEAT);
+ return (pmd_t *)get_zeroed_page(GFP_KERNEL|__GFP_REPEAT|
+ __GFP_BC | __GFP_BC_LIMIT);
}

static inline pud_t *pud_alloc_one(struct mm_struct *mm, unsigned long addr)
{
- return (pud_t *)get_zeroed_page(GFP_KERNEL|__GFP_REPEAT);
+ return (pud_t *)get_zeroed_page(GFP_KERNEL|__GFP_REPEAT|
+ __GFP_BC | __GFP_BC_LIMIT);
}

static inline void pud_free (pud_t *pud)
@@ -74,7 +76,8 @@ static inline void pgd_list_del(pgd_t *p

```

```

static inline pgd_t *pgd_alloc(struct mm_struct *mm)
{
    unsigned boundary;
- pgd_t *pgd = (pgd_t *)__get_free_page(GFP_KERNEL|__GFP_REPEAT);
+ pgd_t *pgd = (pgd_t *)__get_free_page(GFP_KERNEL|__GFP_REPEAT|
+ __GFP_BC | __GFP_BC_LIMIT);
    if (!pgd)
        return NULL;
    pgd_list_add(pgd);
@@ -105,7 +108,8 @@ static inline pte_t *pte_alloc_one_kerne

static inline struct page *pte_alloc_one(struct mm_struct *mm, unsigned long address)
{
- void *p = (void *)__get_zeroed_page(GFP_KERNEL|__GFP_REPEAT);
+ void *p = (void *)__get_zeroed_page(GFP_KERNEL|__GFP_REPEAT|
+ __GFP_BC | __GFP_BC_LIMIT);
    if (!p)
        return NULL;
    return virt_to_page(p);
--- ./include/asm-x86_64/thread_info.h.bckmcmc 2006-08-28 12:20:13.000000000 +0400
+++ ./include/asm-x86_64/thread_info.h 2006-08-28 13:05:46.000000000 +0400
@@ -78,14 +78,15 @@ static inline struct thread_info *stack_
    ({
        \
        struct thread_info *ret; \
        \
- ret = ((struct thread_info *)__get_free_pages(GFP_KERNEL,THREAD_ORDER)); \
+ ret = ((struct thread_info *)__get_free_pages(GFP_KERNEL_BC, \
+ THREAD_ORDER)); \
    if (ret) \
        memset(ret, 0, THREAD_SIZE); \
    ret; \
    })
#else
#define alloc_thread_info(tsk) \
- ((struct thread_info *)__get_free_pages(GFP_KERNEL,THREAD_ORDER))
+ ((struct thread_info *)__get_free_pages(GFP_KERNEL_BC,THREAD_ORDER))
#endif

#define free_thread_info(ti) free_pages((unsigned long) (ti), THREAD_ORDER)
--- ./ipc/msgutil.c.bckmcmc 2006-04-21 11:59:36.000000000 +0400
+++ ./ipc/msgutil.c 2006-08-28 13:05:46.000000000 +0400
@@ -36,7 +36,7 @@ struct msg_msg *load_msg(const void __us
    if (alen > DATALEN_MSG)
        alen = DATALEN_MSG;

- msg = (struct msg_msg *)kmalloc(sizeof(*msg) + alen, GFP_KERNEL);
+ msg = (struct msg_msg *)kmalloc(sizeof(*msg) + alen, GFP_KERNEL_BC);
    if (msg == NULL)

```

```

return ERR_PTR(-ENOMEM);

@@ -57,7 +57,7 @@ struct msg_msg *load_msg(const void __us
    if (alen > DATALEN_SEG)
        alen = DATALEN_SEG;
    seg = (struct msg_msgseg *)kmalloc(sizeof(*seg) + alen,
-    GFP_KERNEL);
+    GFP_KERNEL_BC);
    if (seg == NULL) {
        err = -ENOMEM;
        goto out_err;
--- ./ipc/sem.c.bckmemc 2006-08-28 12:20:13.000000000 +0400
+++ ./ipc/sem.c 2006-08-28 13:05:46.000000000 +0400
@@ -1006,7 +1006,7 @@ static inline int get_undo_list(struct s

    undo_list = current->sysvsem.undo_list;
    if (!undo_list) {
-    undo_list = kzalloc(sizeof(*undo_list), GFP_KERNEL);
+    undo_list = kzalloc(sizeof(*undo_list), GFP_KERNEL_BC);
        if (undo_list == NULL)
            return -ENOMEM;
        spin_lock_init(&undo_list->lock);
@@ -1069,7 +1069,8 @@ static struct sem_undo *find_undo(struct
    ipc_rcu_getref(sma);
    sem_unlock(sma);

-    new = (struct sem_undo *) kmalloc(sizeof(struct sem_undo) + sizeof(short)*nsems,
GFP_KERNEL);
+    new = (struct sem_undo *) kmalloc(sizeof(struct sem_undo) +
+    sizeof(short)*nsems, GFP_KERNEL_BC);
    if (!new) {
        ipc_lock_by_ptr(&sma->sem_perm);
        ipc_rcu_putref(sma);
@@ -1130,7 +1131,7 @@ asmlinkage long sys_semtimeop(int semid
    if (nsops > ns->sc_semopm)
        return -E2BIG;
    if (nsops > SEMOPM_FAST) {
-    sops = kmalloc(sizeof(*sops)*nsops, GFP_KERNEL);
+    sops = kmalloc(sizeof(*sops)*nsops, GFP_KERNEL_BC);
        if (sops == NULL)
            return -ENOMEM;
    }
--- ./ipc/util.c.bckmemc 2006-08-28 12:20:13.000000000 +0400
+++ ./ipc/util.c 2006-08-28 13:05:46.000000000 +0400
@@ -406,9 +406,9 @@ void* ipc_alloc(int size)
{
    void* out;
    if (size > PAGE_SIZE)

```

```

- out = vmalloc(size);
+ out = vmalloc_bc(size);
  else
- out = kmalloc(size, GFP_KERNEL);
+ out = kmalloc(size, GFP_KERNEL_BC);
  return out;
}

```

```

@@ -491,14 +491,14 @@ void* ipc_rcu_alloc(int size)

```

```

  * workqueue if necessary (for vmalloc).
  */
  if (rcu_use_vmalloc(size)) {
- out = vmalloc(HDRLEN_VMALLOC + size);
+ out = vmalloc_bc(HDRLEN_VMALLOC + size);
    if (out) {
      out += HDRLEN_VMALLOC;
      container_of(out, struct ipc_rcu_hdr, data)->is_vmalloc = 1;
      container_of(out, struct ipc_rcu_hdr, data)->refcount = 1;
    }
  } else {
- out = kmalloc(HDRLEN_KMALLOC + size, GFP_KERNEL);
+ out = kmalloc(HDRLEN_KMALLOC + size, GFP_KERNEL_BC);
    if (out) {
      out += HDRLEN_KMALLOC;
      container_of(out, struct ipc_rcu_hdr, data)->is_vmalloc = 0;
--- ./kernel/fork.c.bckmemc 2006-08-28 12:52:11.000000000 +0400
+++ ./kernel/fork.c 2006-08-28 13:05:46.000000000 +0400

```

```

@@ -142,7 +142,7 @@ void __init fork_init(unsigned long memp
  /* create a slab on which task_structs can be allocated */
  task_struct_cachep =
    kmem_cache_create("task_struct", sizeof(struct task_struct),
- ARCH_MIN_TASKALIGN, SLAB_PANIC, NULL, NULL);
+ ARCH_MIN_TASKALIGN, SLAB_PANIC | SLAB_BC, NULL, NULL);
#endif

```

```

/*
@@ -1435,23 +1435,24 @@ void __init proc_caches_init(void)
{
  sighand_cachep = kmem_cache_create("sighand_cache",
    sizeof(struct sighand_struct), 0,
- SLAB_HWCACHE_ALIGN|SLAB_PANIC|SLAB_DESTROY_BY_RCU,
+ SLAB_HWCACHE_ALIGN | SLAB_PANIC | \
+ SLAB_DESTROY_BY_RCU | SLAB_BC,
    sighand_ctor, NULL);
  signal_cachep = kmem_cache_create("signal_cache",
    sizeof(struct signal_struct), 0,
- SLAB_HWCACHE_ALIGN|SLAB_PANIC, NULL, NULL);
+ SLAB_HWCACHE_ALIGN|SLAB_PANIC|SLAB_BC, NULL, NULL);

```

```

files_cachep = kmem_cache_create("files_cache",
    sizeof(struct files_struct), 0,
-   SLAB_HWCACHE_ALIGN|SLAB_PANIC, NULL, NULL);
+   SLAB_HWCACHE_ALIGN|SLAB_PANIC|SLAB_BC, NULL, NULL);
fs_cachep = kmem_cache_create("fs_cache",
    sizeof(struct fs_struct), 0,
-   SLAB_HWCACHE_ALIGN|SLAB_PANIC, NULL, NULL);
+   SLAB_HWCACHE_ALIGN|SLAB_PANIC|SLAB_BC, NULL, NULL);
vm_area_cachep = kmem_cache_create("vm_area_struct",
    sizeof(struct vm_area_struct), 0,
-   SLAB_PANIC, NULL, NULL);
+   SLAB_PANIC|SLAB_BC, NULL, NULL);
mm_cachep = kmem_cache_create("mm_struct",
    sizeof(struct mm_struct), ARCH_MIN_MMSTRUCT_ALIGN,
-   SLAB_HWCACHE_ALIGN|SLAB_PANIC, NULL, NULL);
+   SLAB_HWCACHE_ALIGN|SLAB_PANIC|SLAB_BC, NULL, NULL);
}

```

```

--- ./kernel/posix-timers.c.bckmemc 2006-08-28 12:20:13.000000000 +0400
+++ ./kernel/posix-timers.c 2006-08-28 13:05:46.000000000 +0400
@@ -242,7 +242,8 @@ static __init int init_posix_timers(void
    register_posix_clock(CLOCK_MONOTONIC, &clock_monotonic);

```

```

    posix_timers_cache = kmem_cache_create("posix_timers_cache",
-   sizeof (struct k_itimer), 0, 0, NULL, NULL);
+   sizeof (struct k_itimer), 0, SLAB_BC,
+   NULL, NULL);
    idr_init(&posix_timers_id);
    return 0;
}

```

```

--- ./kernel/signal.c.bckmemc 2006-08-28 12:20:13.000000000 +0400
+++ ./kernel/signal.c 2006-08-28 13:05:46.000000000 +0400
@@ -2744,5 +2744,5 @@ void __init signals_init(void)
    kmem_cache_create("sigqueue",
        sizeof(struct sigqueue),
        __alignof__(struct sigqueue),
-   SLAB_PANIC, NULL, NULL);
+   SLAB_PANIC | SLAB_BC, NULL, NULL);
}

```

```

--- ./kernel/user.c.bckmemc 2006-08-28 12:32:54.000000000 +0400
+++ ./kernel/user.c 2006-08-28 13:05:46.000000000 +0400
@@ -194,7 +194,7 @@ static int __init uid_cache_init(void)
    int n;

```

```

    uid_cachep = kmem_cache_create("uid_cache", sizeof(struct user_struct),
-   0, SLAB_HWCACHE_ALIGN|SLAB_PANIC, NULL, NULL);
+   0, SLAB_HWCACHE_ALIGN|SLAB_PANIC|SLAB_BC, NULL, NULL);

```

```

for(n = 0; n < UIDHASH_SZ; ++n)
  INIT_LIST_HEAD(uidhash_table + n);
--- ./mm/rmap.c.bckmemc 2006-08-28 12:20:13.000000000 +0400
+++ ./mm/rmap.c 2006-08-28 13:05:46.000000000 +0400
@@ -179,7 +179,8 @@ static void anon_vma_ctor(void *data, st
void __init anon_vma_init(void)
{
  anon_vma_cachep = kmem_cache_create("anon_vma", sizeof(struct anon_vma),
- 0, SLAB_DESTROY_BY_RCU|SLAB_PANIC, anon_vma_ctor, NULL);
+ 0, SLAB_DESTROY_BY_RCU|SLAB_PANIC|SLAB_BC,
+ anon_vma_ctor, NULL);
}

/*
--- ./mm/shmem.c.bckmemc 2006-08-28 12:20:13.000000000 +0400
+++ ./mm/shmem.c 2006-08-28 13:05:46.000000000 +0400
@@ -368,7 +368,8 @@ static swp_entry_t *shmem_swp_alloc(stru
}

spin_unlock(&info->lock);
- page = shmem_dir_alloc(mapping_gfp_mask(inode->i_mapping) | __GFP_ZERO);
+ page = shmem_dir_alloc(mapping_gfp_mask(inode->i_mapping) | \
+ __GFP_ZERO | __GFP_BC);
if (page)
  set_page_private(page, 0);
spin_lock(&info->lock);

```

---

Subject: Re: [PATCH 6/7] BC: kernel memory (core)  
 Posted by [Balbir Singh](#) on Tue, 29 Aug 2006 18:41:46 GMT  
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---

Kirill Korotaev wrote:

- > Introduce BC\_KMEMSIZE resource which accounts kernel
- > objects allocated by task's request.
- >
- > Reference to BC is kept on struct page or slab object.
- > For slabs each struct slab contains a set of pointers
- > corresponding objects are charged to.
- >
- > Allocation charge rules:
- > 1. Pages - if allocation is performed with \_\_GFP\_BC flag - page
- > is charged to current's exec\_bc.
- > 2. Slabs - kmem\_cache may be created with SLAB\_BC flag - in this
- > case each allocation is charged. Caches used by kmalloc are
- > created with SLAB\_BC | SLAB\_BC\_NOCHARGE flags. In this case
- > only \_\_GFP\_BC allocations are charged.



>

<snip>

```
> #define __GFP_BC_LIMIT ((__force gfp_t)0x100000u) /* Charge against BC
> limit */
>
```

What's `__GFP_BC_LIMIT` for, could you add the description for that flag?  
The comment is not very clear

```
> #ifdef CONFIG_BEANCOUNTERS
> + union {
> +     struct beancounter *page_bc;
> + } bc;
> #endif
> };
>
> #define page_bc(page) ((page)->bc.page_bc)
```

Minor comment - `page->(bc).page_bc` has too many repetitions of `page` and `bc` - see the Practice of Programming by Kernighan and Pike

I missed the part of why you wanted to have a union (in struct `page` for `bc`)?

```
> const char *bc_rnames[] = {
> + "kmemsize", /* 0 */
> };
>
> static struct hlist_head bc_hash[BC_HASH_SIZE];
> @@ -221,6 +222,8 @@ static void init_beancounter_syslimits(s
> {
>     int k;
>
> + bc->bc_parms[BC_KMEMSIZE].limit = 32 * 1024 * 1024;
> +
```

Can't this be configurable `CONFIG_XXX` or a `#defined` constant?

```
> --- ./mm/mempool.c.bckmem 2006-04-21 11:59:36.000000000 +0400
> +++ ./mm/mempool.c 2006-08-28 12:59:28.000000000 +0400
> @@ -119,6 +119,7 @@ int mempool_resize(mempool_t *pool, int unsigned
> long flags;
>
>     BUG_ON(new_min_nr <= 0);
> + gfp_mask &= ~__GFP_BC;
>
>     spin_lock_irqsave(&pool->lock, flags);
```

```

> if (new_min_nr <= pool->min_nr) {
> @@ -212,6 +213,7 @@ void * mempool_alloc(mempool_t *pool, gf
> gfp_mask |= __GFP_NOMEMALLOC; /* don't allocate emergency
> reserves */
> gfp_mask |= __GFP_NORETRY; /* don't loop in __alloc_pages */
> gfp_mask |= __GFP_NOWARN; /* failures are OK */
> + gfp_mask &= ~__GFP_BC; /* do not charge */
>
> gfp_temp = gfp_mask & ~(__GFP_WAIT|__GFP_IO);
>

```

Is there any reason why mempool\_xxxx() functions are not charged? Is it because mempool functions are mostly used from the I/O path?

```

> --- ./mm/page_alloc.c.bckmem 2006-08-28 12:20:13.000000000 +0400
> +++ ./mm/page_alloc.c 2006-08-28 12:59:28.000000000 +0400
> @@ -40,6 +40,8 @@
> #include <linux/sort.h>
> #include <linux/pfn.h>
>
> +#include <bc/kmem.h>
> +
> #include <asm/tlbflush.h>
> #include <asm/div64.h>
> #include "internal.h"
> @@ -516,6 +518,8 @@ static void __free_pages_ok(struct page if
> (reserved)
> return;
>
> + bc_page_uncharge(page, order);
> +
> kernel_map_pages(page, 1 << order, 0);
> local_irq_save(flags);
> __count_vm_events(PGFREE, 1 << order);
> @@ -799,6 +803,8 @@ static void fastcall free_hot_cold_page(
> if (free_pages_check(page))
> return;
>
> + bc_page_uncharge(page, 0);
> +
> kernel_map_pages(page, 1, 0);
>
> pcp = &zone_pcp(zone, get_cpu())->pcp[cold];
> @@ -1188,6 +1194,11 @@ nopage:
> show_mem();
> }
> got_pg:
> + if ((gfp_mask & __GFP_BC) &&

```

```
> + bc_page_charge(page, order, gfp_mask) {
```

I wonder if `bc_page_charge()` should be called `bc_page_charge_failed()`? Does it make sense to atleast partially start reclamation here? I know with bean counters we cannot reclaim from a particular container, but for now we could kick off `kswapd()` or call `shrink_all_memory()` inline (Dave's patches do this to shrink memory from the particular cpuset). Or do you want to leave this slot open for later?

```
> + __free_pages(page, order);
> + page = NULL;
> + }
```

--

Balbir Singh,  
Linux Technology Center,  
IBM Software Labs

---

Subject: Re: [ckrm-tech] [PATCH 6/7] BC: kernel memory (core)

Posted by [Dave Hansen](#) on Tue, 29 Aug 2006 20:29:42 GMT

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---

On Tue, 2006-08-29 at 18:58 +0400, Kirill Korotaev wrote:

```
> @@ -274,8 +274,14 @@ struct page {
>     unsigned int gfp_mask;
>     unsigned long trace[8];
> #endif
> +#ifdef CONFIG_BEANCOUNTERS
> +     union {
> +         struct beancounter *page_bc;
> +     } bc;
> +#endif
> };
```

I know you're probably saving this union for when you put some userspace stuff in here or something. But, for now, it would probably be best just to leave it as a plain struct, or even an anonymous union.

You probably had to use gcc 2 when this was written and couldn't use anonymous unions, right?

-- Dave

Subject: Re: [PATCH 2/7] BC: kconfig  
Posted by [rdunlap](#) on Wed, 30 Aug 2006 04:02:53 GMT  
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---

On Tue, 29 Aug 2006 18:51:20 +0400 Kirill Korotaev wrote:

```
> Add kernel/bc/Kconfig file with BC options and
> include it into arch Kconfigs
>
> ---
> init/Kconfig | 2 ++
> kernel/bc/Kconfig | 25 ++++++
> 2 files changed, 27 insertions(+)
>
> --- ./init/Kconfig.bckm 2006-07-10 12:39:10.000000000 +0400
> +++ ./init/Kconfig 2006-07-28 14:10:41.000000000 +0400
> @@ -222,6 +222,8 @@ source "crypto/Kconfig"
>
> Say N if unsure.
>
> +source "kernel/bc/Kconfig"
> +
> config SYSCTL
> bool
>
> --- ./kernel/bc/Kconfig.bckm 2006-07-28 13:07:38.000000000 +0400
> +++ ./kernel/bc/Kconfig 2006-07-28 13:09:51.000000000 +0400
> @@ -0,0 +1,25 @@
> +#
> +# Resource beancounters (BC)
> +#
> +# Copyright (C) 2006 OpenVZ. SWsoft Inc
> +
> +menu "User resources"
> +
> +config BEANCOUNTERS
> + bool "Enable resource accounting/control"
> + default n
> + help
> + When Y this option provides accounting and allows to configure
```

"allows" needs an object after it, like "you" or "one".

```
> + limits for user's consumption of exhaustible system resources.
> + The most important resource controlled by this patch is unswappable
> + memory (either mlock'ed or used by internal kernel structures and
> + buffers). The main goal of this patch is to protect processes
> + from running short of important resources because of an accidental
```

drop "an"

> + misbehavior of processes or malicious activity aiming to ``kill"  
> + the system. It's worth to mention that resource limits configured

s/to mention/mentioning/

> + by setrlimit(2) do not give an acceptable level of protection  
> + because they cover only small fraction of resources and work on a

"only a small fraction"

> + per-process basis. Per-process accounting doesn't prevent malicious  
> + users from spawning a lot of resource-consuming processes.  
> +  
> +endmenu

and there are several lines that end with <space> (don't do that :).

---

~Randy

---

Subject: Re: [PATCH 1/7] introduce atomic\_dec\_and\_lock\_irqsave()  
Posted by [Roman Zippel](#) on Wed, 30 Aug 2006 09:59:48 GMT  
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---

Hi,

On Tue, 29 Aug 2006, Kirill Korotaev wrote:

```
> --- ./kernel/user.c.dlirq 2006-07-10 12:39:20.000000000 +0400
> +++ ./kernel/user.c 2006-08-28 11:08:56.000000000 +0400
> @@ -108,15 +108,12 @@ void free_uid(struct user_struct *up)
> if (!up)
> return;
>
> - local_irq_save(flags);
> - if (atomic_dec_and_lock(&up->__count, &uidhash_lock)) {
> + if (atomic_dec_and_lock_irqsave(&up->__count, &uidhash_lock, flags)) {
> uid_hash_remove(up);
> spin_unlock_irqrestore(&uidhash_lock, flags);
> key_put(up->uid_keyring);
> key_put(up->session_keyring);
> kmem_cache_free(uid_cache, up);
> - } else {
> - local_irq_restore(flags);
> }
```

> }

Why does this need protection against interrupts?

bye, Roman

---

---

Subject: Re: [PATCH 1/7] introduce atomic\_dec\_and\_lock\_irqsave()

Posted by [Roman Zippel](#) on Wed, 30 Aug 2006 10:51:28 GMT

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---

Hi,

On Wed, 30 Aug 2006, Oleg Nesterov wrote:

> > Why does this need protection against interrupts?

>

> uidhash\_lock can be taken from irq context. For example, delayed\_put\_task\_struct()

> does \_\_put\_task\_struct()->free\_uid().

AFAICT it's called via rcu, does that mean anything released via rcu has to be protected against interrupts?

bye, Roman

---

---

Subject: Re: [PATCH 1/7] introduce atomic\_dec\_and\_lock\_irqsave()

Posted by [Oleg Nesterov](#) on Wed, 30 Aug 2006 11:27:53 GMT

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---

On 08/30, Roman Zippel wrote:

> Hi,

>

> On Wed, 30 Aug 2006, Oleg Nesterov wrote:

>

> > > Why does this need protection against interrupts?

> >

> > uidhash\_lock can be taken from irq context. For example, delayed\_put\_task\_struct()

> > does \_\_put\_task\_struct()->free\_uid().

>

> AFAICT it's called via rcu, does that mean anything released via rcu has

> to be protected against interrupts?

RCU means softirq, probably we can use spin\_lock\_bh() to protect against deadlock. But free\_uid() may be called with irqs disabled, we can't use local\_bh\_enable() in such a case.

Oleg.

---

---

Subject: Re: [PATCH 1/7] introduce atomic\_dec\_and\_lock\_irqsave()

Posted by [Roman Zippel](#) on Wed, 30 Aug 2006 11:54:51 GMT

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---

Hi,

On Wed, 30 Aug 2006, Oleg Nesterov wrote:

> > AFAICT it's called via rcu, does that mean anything released via rcu has  
> > to be protected against interrupts?  
>  
> RCU means softirq, probably we can use spin\_lock\_bh() to protect against deadlock.  
> But free\_uid() may be called with irqs disabled, we can't use local\_bh\_enable()  
> in such a case.

Eek, I wasn't really aware of it and this would really suck. We should  
move things out of the interrupt context and not into it. :(  
I would call it a bug in the rcu system.

bye, Roman

---

---

Subject: Re: [PATCH 1/7] introduce atomic\_dec\_and\_lock\_irqsave()

Posted by [Oleg Nesterov](#) on Wed, 30 Aug 2006 12:01:38 GMT

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---

On 08/30, Roman Zippel wrote:

> Hi,  
>  
> On Tue, 29 Aug 2006, Kirill Korotaev wrote:  
>  
> > --- ./kernel/user.c.dlirq 2006-07-10 12:39:20.000000000 +0400  
> > +++ ./kernel/user.c 2006-08-28 11:08:56.000000000 +0400  
> > @@ -108,15 +108,12 @@ void free\_uid(struct user\_struct \*up)  
> > if (!up)  
> > return;  
> >  
> > - local\_irq\_save(flags);  
> > - if (atomic\_dec\_and\_lock(&up->\_\_count, &uidhash\_lock)) {  
> > + if (atomic\_dec\_and\_lock\_irqsave(&up->\_\_count, &uidhash\_lock, flags)) {  
> > uid\_hash\_remove(up);  
> > spin\_unlock\_irqrestore(&uidhash\_lock, flags);  
> > key\_put(up->uid\_keyring);  
> > key\_put(up->session\_keyring);

```
> > kmem_cache_free(uid_cachep, up);
> > - } else {
> > - local_irq_restore(flags);
> > }
> > }
> > }
>
> Why does this need protection against interrupts?
```

uidhash\_lock can be taken from irq context. For example, delayed\_put\_task\_struct() does \_\_put\_task\_struct()->free\_uid().

Oleg.

---

---

Subject: Re: [PATCH 1/7] introduce atomic\_dec\_and\_lock\_irqsave()  
Posted by [Dipankar Sarma](#) on Wed, 30 Aug 2006 16:58:51 GMT  
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---

On Wed, Aug 30, 2006 at 12:51:28PM +0200, Roman Zippel wrote:

```
> Hi,
>
> On Wed, 30 Aug 2006, Oleg Nesterov wrote:
>
> > > Why does this need protection against interrupts?
> >
> > uidhash_lock can be taken from irq context. For example, delayed_put_task_struct()
> > does __put_task_struct()->free_uid().
>
> AFAICT it's called via rcu, does that mean anything released via rcu has
> to be protected against interrupts?
```

No. You need protection only if you have are using some data that can also be used by the RCU callback. For example, if your RCU callback just calls kfree(), you don't have to do a spin\_lock\_bh().

Thanks  
Dipankar

---

---

Subject: Re: [PATCH 1/7] introduce atomic\_dec\_and\_lock\_irqsave()  
Posted by [Roman Zippel](#) on Wed, 30 Aug 2006 17:25:07 GMT  
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---

Hi,

On Wed, 30 Aug 2006, Dipankar Sarma wrote:



> > > uidhash\_lock can be taken from irq context. For example, delayed\_put\_task\_struct()  
> > > does \_\_put\_task\_struct()->free\_uid().  
> >  
> > AFAICT it's called via rcu, does that mean anything released via rcu has  
> > to be protected against interrupts?  
>  
> No. You need protection only if you have are using some  
> data that can also be used by the RCU callback. For example,  
> if your RCU callback just calls kfree(), you don't have to  
> do a spin\_lock\_bh().

In this case kfree() does its own interrupt synchronization. I didn't realize before that rcu had this (IMO serious) limitation. I think there should be two call\_rcu() variants, one that queues the callback in a soft irq and a second which queues it in a thread context.

bye, Roman

---

Subject: Re: [ckrm-tech] [PATCH 3/7] BC: beancounters core (API)  
Posted by [Chandra Seetharaman](#) on Wed, 30 Aug 2006 18:58:34 GMT  
[View Forum Message](#) <> [Reply to Message](#)

---

On Tue, 2006-08-29 at 18:53 +0400, Kirill Korotaev wrote:

> Core functionality and interfaces of BC:  
> find/create beancounter, initialization,  
> charge/uncharge of resource, core objects' declarations.  
>  
> Basic structures:  
> bc\_resource\_parm - resource description  
> beancounter - set of resources, id, lock  
>  
> Signed-off-by: Pavel Emelianov <xemul@sw.ru>  
> Signed-off-by: Kirill Korotaev <dev@sw.ru>  
>  
> ---  
>  
> include/bc/beancounter.h | 150 +++++  
> include/linux/types.h | 16 ++  
> init/main.c | 4  
> kernel/Makefile | 1  
> kernel/bc/Makefile | 7 +  
> kernel/bc/beancounter.c | 256 +++++  
> 6 files changed, 434 insertions(+)  
>  
> --- /dev/null 2006-07-18 14:52:43.075228448 +0400  
> +++ ./include/bc/beancounter.h 2006-08-28 12:47:52.000000000 +0400

```

> @@ -0,0 +1,150 @@
> +/*
> + * include/bc/beancounter.h
> + *
> + * Copyright (C) 2006 OpenVZ. SWsoft Inc
> + *
> + */
> +
> + #ifndef _LINUX_BEANCOUNTER_H
> + #define _LINUX_BEANCOUNTER_H
> +
> + /*
> + * Resource list.
> + */
> +
> + #define BC_RESOURCES 0
> +
> + struct bc_resource_parm {
> +     unsigned long barrier; /* A barrier over which resource allocations
> +     * are failed gracefully. e.g. if the amount
> +     * of consumed memory is over the barrier
> +     * further sbrk() or mmap() calls fail, the
> +     * existing processes are not killed.
> +     */
> +     unsigned long limit; /* hard resource limit */
> +     unsigned long held; /* consumed resources */
> +     unsigned long maxheld; /* maximum amount of consumed resources */
> +     unsigned long minheld; /* minimum amount of consumed resources */
> +     unsigned long failcnt; /* count of failed charges */
> + };
> +
> + /*
> + * Kernel internal part.
> + */
> +
> + #ifdef __KERNEL__
> +
> + #include <linux/spinlock.h>
> + #include <linux/list.h>
> + #include <asm/atomic.h>
> +
> + #define BC_MAXVALUE LONG_MAX
> +
> + /*
> + * Resource management structures
> + * Serialization issues:
> + * beancounter list management is protected via bc_hash_lock
> + * task pointers are set only for current task and only once

```

```

> + * refcount is managed atomically
> + * value and limit comparison and change are protected by per-bc spinlock
> + */
> +
> +struct beancounter {
> + atomic_t bc_refcount;
> + spinlock_t bc_lock;
> + bcid_t bc_id;
> + struct hlist_node hash;
> +
> + /* resources statistics and settings */
> + struct bc_resource_parm bc_parms[BC_RESOURCES];
> +};

```

Do we need the full data structure to be visible when CONFIG\_BEANCOUNTERS is not defined ?

```

> +
> +enum bc_severity { BC_BARRIER, BC_LIMIT, BC_FORCE };
> +
> +/* Flags passed to beancounter_findcreate() */
> +#define BC_LOOKUP 0x00
> +#define BC_ALLOC 0x01 /* May allocate new one */
> +#define BC_ALLOC_ATOMIC 0x02 /* Allocate with GFP_ATOMIC */

```

These are required to be visible when CONFIG\_BEANCOUNTERS is not defined ?

>From these definitions it is not obvious that both BC\_ALLOC and BC\_ALLOC\_ATOMIC need to be set to allocate a beancounter atomically. More comments below (in beancounter\_findcreate).

```

> +
> +#define BC_HASH_BITS 8
> +#define BC_HASH_SIZE (1 << BC_HASH_BITS)

```

Are these needed in this global file ?

```

> +
> +#ifdef CONFIG_BEANCOUNTERS
> +
> +/*
> + * This function tunes minheld and maxheld values for a given
> + * resource when held value changes
> + */
> +static inline void bc_adjust_held_minmax(struct beancounter *bc,
> + int resource)
> +{
> + struct bc_resource_parm *parm;

```

```
> +
> + parm = &bc->bc_parms[resource];
> + if (parm->maxheld < parm->held)
> +   parm->maxheld = parm->held;
> + if (parm->minheld > parm->held)
> +   parm->minheld = parm->held;
> + }
```

Why is function defined in this global file ? Can be moved to beancounter.c

Also, from the usages it looks like only one of the conditions would succeed (i.e when value is increased maxheld check might succeed and when value is decreased minheld check might succeed). Why not just put the single check in appropriate context ?

```
> +
> +int __must_check bc_charge_locked(struct beancounter *bc,
> + int res, unsigned long val, enum bc_severity strict);
```

Why do we need the \_locked to be exported ?

It is needed to be exported, it needs to be \_locked\_irq since we expect the irqs to be disabled when this function is called.

```
> +int __must_check bc_charge(struct beancounter *bc,
> + int res, unsigned long val, enum bc_severity strict);
> +
> +void bc_uncharge_locked(struct beancounter *bc, int res, unsigned long val);
> +void bc_uncharge(struct beancounter *bc, int res, unsigned long val);
> +
> +struct beancounter *beancounter_findcreate(bcid_t id, int mask);
```

prototype do not need the parameter names, types would suffice (would save you few characters).

```
> +
> +static inline struct beancounter *get_beancounter(struct beancounter *bc)
> +{
> +   atomic_inc(&bc->bc_refcount);
> +   return bc;
> +}
> +
> +void put_beancounter(struct beancounter *bc);
> +
> +void bc_init_early(void);
> +void bc_init_late(void);
> +void bc_init_proc(void);
```

```
> +
> +extern struct beancounter init_bc;
> +extern const char *bc_rnames[];
```

Why bc\_rnames need to be exported ? I do not see it being used outside of beancounter.c (leftover from /proc removal, I guess).

```
> +
> +#else /* CONFIG_BEANCOUNTERS */
> +
> +#define beancounter_findcreate(id, f) (NULL)
> +#define get_beancounter(bc) (NULL)
> +#define put_beancounter(bc) do { } while (0)
> +
> +static inline __must_check int bc_charge_locked(struct beancounter *bc,
> + int res, unsigned long val, enum bc_severity strict)
> +{
> + return 0;
> +}
> +
> +static inline __must_check int bc_charge(struct beancounter *bc,
> + int res, unsigned long val, enum bc_severity strict)
> +{
> + return 0;
> +}
> +
> +static inline void bc_uncharge_locked(struct beancounter *bc, int res,
> + unsigned long val)
> +{
> +}
> +
> +static inline void bc_uncharge(struct beancounter *bc, int res,
> + unsigned long val)
> +{
> +}
> +
> +#define bc_init_early() do { } while (0)
> +#define bc_init_late() do { } while (0)
> +#define bc_init_proc() do { } while (0)
> +
> +#endif /* CONFIG_BEANCOUNTERS */
> +#endif /* __KERNEL__ */
> +
> +#endif /* _LINUX_BEANCOUNTER_H */
> --- ./include/linux/types.h.bccore 2006-08-28 12:20:13.000000000 +0400
> +++ ./include/linux/types.h 2006-08-28 12:44:13.000000000 +0400
> @@ -40,6 +40,21 @@ typedef __kernel_gid32_t gid_t;
> typedef __kernel_uid16_t uid16_t;
```

```

> typedef __kernel_gid16_t    gid16_t;
>
> +/*
> + * Type of beancounter id (CONFIG_BEANCOUNTERS)
> + *
> + * The ancient Unix implementations of this kind of resource management and
> + * security are built around setuid() which sets a uid value that cannot
> + * be changed again and is normally used for security purposes. That
> + * happened to be a uid_t and in simple setups at login uid = luid = euid
> + * would be the norm.
> + *
> + * Thus the Linux one happens to be a uid_t. It could be something else but
> + * for the "container per user" model whatever a container is must be able
> + * to hold all possible uid_t values. Alan Cox.

```

Is this comment block still valid/needed ?

```

> + */
> +typedef uid_t    bcid_t;

```

Why do we need a typedef ? it is not opaque anyways. Can't we use a unsigned long or unsigned int or \_\_u32 or something else ?

```

> +
> #ifdef CONFIG_UID16
> /* This is defined by include/asm-{arch}/posix_types.h */
> typedef __kernel_old_uid_t old_uid_t;
> @@ -52,6 +67,7 @@ typedef __kernel_old_gid_t old_gid_t;
> #else
> typedef __kernel_uid_t uid_t;
> typedef __kernel_gid_t gid_t;
> +typedef __kernel_uid_t bcid_t;
> #endif /* __KERNEL__ */
>
> #if defined(__GNUC__) && !defined(__STRICT_ANSI__)
> --- ./init/main.c.bccore 2006-08-28 12:20:13.000000000 +0400
> +++ ./init/main.c 2006-08-28 12:43:34.000000000 +0400
> @@ -52,6 +52,8 @@
> #include <linux/debug_locks.h>
> #include <linux/lockdep.h>
>
> +#include <bc/beancounter.h>
> +
> #include <asm/io.h>
> #include <asm/bugs.h>
> #include <asm/setup.h>
> @@ -495,6 +497,7 @@ asmlinkage void __init start_kernel(void
> early_boot_irqs_off();
> early_init_irq_lock_class();

```

```

>
> + bc_init_early();
> /*
>  * Interrupts are still disabled. Do necessary setups, then
>  * enable them
> @@ -587,6 +590,7 @@ asmlinkage void __init start_kernel(void
> #endif
> fork_init(num_physpages);
> proc_caches_init();
> + bc_init_late();
> buffer_init();
> unnamed_dev_init();
> key_init();
> --- ./kernel/Makefile.bccore 2006-08-28 12:20:13.000000000 +0400
> +++ ./kernel/Makefile 2006-08-28 12:43:34.000000000 +0400
> @@ -12,6 +12,7 @@ obj-y    = sched.o fork.o exec_domain.o
>
> obj-$(CONFIG_STACKTRACE) += stacktrace.o
> obj-y += time/
> +obj-y += bc/

```

Instead of having it this way, we can have it  
obj-\$(CONFIG\_BEANCOUNTERS) += bc/

and the Makefile in bc will have only obj-y = beancounter.o ...

```

> obj-$(CONFIG_DEBUG_MUTEXES) += mutex-debug.o
> obj-$(CONFIG_LOCKDEP) += lockdep.o
> ifeq ($(CONFIG_PROC_FS),y)
> --- /dev/null 2006-07-18 14:52:43.075228448 +0400
> +++ ./kernel/bc/Makefile 2006-08-28 12:43:34.000000000 +0400
> @@ -0,0 +1,7 @@
> +#
> +# Beancounters (BC)
> +#
> +# Copyright (C) 2006 OpenVZ. SWsoft Inc
> +#
> +
> +obj-$(CONFIG_BEANCOUNTERS) += beancounter.o
> --- /dev/null 2006-07-18 14:52:43.075228448 +0400
> +++ ./kernel/bc/beancounter.c 2006-08-28 12:49:07.000000000 +0400
> @@ -0,0 +1,256 @@
> +/*
> + * kernel/bc/beancounter.c
> + *
> + * Copyright (C) 2006 OpenVZ. SWsoft Inc
> + * Original code by (C) 1998 Alan Cox
> + *
> + * 1998-2000 Andrey Savochkin <saw@saw.sw.com.sg>

```

```

> + */
> +
> + #include <linux/slab.h>
> + #include <linux/module.h>
> + #include <linux/hash.h>
> +
> + #include <bc/beancounter.h>
> +
> + static kmem_cache_t *bc_cache;
> + static struct beancounter default_beancounter;
> +
> + static void init_beancounter_struct(struct beancounter *bc, bcid_t id);
> +
> + struct beancounter init_bc;
> +
> + const char *bc_rnames[] = {
> + };
> +
> + static struct hlist_head bc_hash[BC_HASH_SIZE];
> + static spinlock_t bc_hash_lock;
> + #define bc_hash_fn(bcid) (hash_long(bcid, BC_HASH_BITS))
> +
> + /*
> + * Per resource beancounting. Resources are tied to their bc id.
> + * The resource structure itself is tagged both to the process and
> + * the charging resources (a socket doesn't want to have to search for
> + * things at irq time for example). Reference counters keep things in
> + * hand.
> + *
> + * The case where a user creates resource, kills all his processes and
> + * then starts new ones is correctly handled this way. The refcounters
> + * will mean the old entry is still around with resource tied to it.
> + */
> +
> + struct beancounter *beancounter_findcreate(bcid_t id, int mask)
> + {
> + struct beancounter *new_bc, *bc;
> + unsigned long flags;
> + struct hlist_head *slot;
> + struct hlist_node *pos;
> +
> + slot = &bc_hash[bc_hash_fn(id)];
> + new_bc = NULL;
> +
> + retry:
> + spin_lock_irqsave(&bc_hash_lock, flags);
> + hlist_for_each_entry (bc, pos, slot, hash)
> + if (bc->bc_id == id)

```



```

> + break;
> +
> + if (pos != NULL) {
> + get_beancounter(bc);
> + spin_unlock_irqrestore(&bc_hash_lock, flags);
> +
> + if (new_bc != NULL)
> + kmem_cache_free(bc_cachep, new_bc);
> + return bc;
> + }
> +
> + if (new_bc != NULL)
> + goto out_install;
> +
> + spin_unlock_irqrestore(&bc_hash_lock, flags);
> +
> + if (!(mask & BC_ALLOC))
> + goto out;

```

If only BC\_ALLOC\_ATOMIC is set, the above test would always succeed, and we will return NULL without even trying to alloc.

Either the above check has to be changed to check for both BC\_ALLOC and BC\_ALLOC\_ATOMIC (preferred), or some comment need to be added that both the flags need to be set to allocate atomically.

```

> +
> + new_bc = kmem_cache_alloc(bc_cachep,
> + mask & BC_ALLOC_ATOMIC ? GFP_ATOMIC : GFP_KERNEL);
> + if (new_bc == NULL)
> + goto out;
> +
> + *new_bc = default_beancounter;
> + init_beancounter_struct(new_bc, id);
> + goto retry;
> +
> +out_install:
> + hlist_add_head(&new_bc->hash, slot);
> + spin_unlock_irqrestore(&bc_hash_lock, flags);
> +out:
> + return new_bc;
> +}
> +
> +void put_beancounter(struct beancounter *bc)
> +{
> + int i;
> + unsigned long flags;
> +
> + if (!atomic_dec_and_lock_irqsave(&bc->bc_refcount,

```

```

> + &bc_hash_lock, flags))
> + return;
> +
> + BUG_ON(bc == &init_bc);
> +
> + for (i = 0; i < BC_RESOURCES; i++)
> + if (bc->bc_parms[i].held != 0)
> +   printk("BC: %d has %lu of %s held on put", bc->bc_id,
> +     bc->bc_parms[i].held, bc_rnames[i]);
> +
> + hlist_del(&bc->hash);
> + spin_unlock_irqrestore(&bc_hash_lock, flags);
> +
> + kmem_cache_free(bc_cachep, bc);
> +}
> +
> +EXPORT_SYMBOL(put_beancounter);

```

#### EXPORT\_SYMBOL\_GPL ?

```

> +
> +/*
> + * Generic resource charging stuff
> + */
> +
> +/* called with bc->bc_lock held and interrupts disabled */
> +int bc_charge_locked(struct beancounter *bc, int resource, unsigned long val,
> + enum bc_severity strict)
> +{
> +/*
> + * bc_value <= BC_MAXVALUE, value <= BC_MAXVALUE, and only one addition
> + * at the moment is possible so an overflow is impossible.
> + */
> + bc->bc_parms[resource].held += val;

```

Instead of having teh above statement here, if we move it to be under BC\_FORCE, then we can get rid of the subtraction at the end.

```

> +
> + switch (strict) {
> + case BC_BARRIER:
> + if (bc->bc_parms[resource].held >
> +   bc->bc_parms[resource].barrier)
> +   break;
> + /* fallthrough */
> + case BC_LIMIT:
> + if (bc->bc_parms[resource].held >
> +   bc->bc_parms[resource].limit)
> +   break;

```

```
> + /* fallback */
> + case BC_FORCE:
> + bc_adjust_held_minmax(bc, resource);
```

Only max\_held might be affected by the addition, hence we can just check and set max\_held here.

```
> + return 0;
> + default:
> + BUG();
> + }
> +
> + bc->bc_parms[resource].failcnt++;
> + bc->bc_parms[resource].held -= val;
> + return -ENOMEM;
> +}
> +EXPORT_SYMBOL(bc_charge_locked);
```

Does this need to be exported ?  
EXPORT\_SYMBOL\_GPL.

```
> +
> +int bc_charge(struct beancounter *bc, int resource, unsigned long val,
> + enum bc_severity strict)
> +{
> + int retval;
> + unsigned long flags;
> +
> + BUG_ON(val > BC_MAXVALUE);
> +
> + spin_lock_irqsave(&bc->bc_lock, flags);
> + retval = bc_charge_locked(bc, resource, val, strict);
> + spin_unlock_irqrestore(&bc->bc_lock, flags);
> + return retval;
> +}
> +EXPORT_SYMBOL(bc_charge);
```

EXPORT\_SYMBOL\_GPL

```
> +
> +/* called with bc->bc_lock held and interrupts disabled */
> +void bc_uncharge_locked(struct beancounter *bc, int resource, unsigned long val)
> +{
> + if (unlikely(bc->bc_parms[resource].held < val)) {
> + printk("BC: overcharging bc %d %s: val %lu, holds %lu\n",
> + bc->bc_id, bc_names[resource], val,
> + bc->bc_parms[resource].held);
> + val = bc->bc_parms[resource].held;
> + }
> +
```

```
> + bc->bc_parms[resource].held -= val;
> + bc_adjust_held_minmax(bc, resource);
```

only minheld might be affected here. Can just check/set minheld.

```
> +}
> +EXPORT_SYMBOL(bc_uncharge_locked);
```

This need to be exported ?

EXPORT\_SYMBOL\_GPL

```
> +
> +void bc_uncharge(struct beancounter *bc, int resource, unsigned long val)
> +{
> + unsigned long flags;
> +
```

BUGON needed ? (as in bc\_charge)

```
> + spin_lock_irqsave(&bc->bc_lock, flags);
> + bc_uncharge_locked(bc, resource, val);
> + spin_unlock_irqrestore(&bc->bc_lock, flags);
> +}
> +EXPORT_SYMBOL(bc_uncharge);
```

EXPORT\_SYMBOL\_GPL

```
> +
> +/*
> + * Initialization
> + *
> + * struct beancounter contains
> + * - limits and other configuration settings
> + * - structural fields: lists, spinlocks and so on.
> + *
> + * Before these parts are initialized, the structure should be memset
> + * to 0 or copied from a known clean structure. That takes care of a lot
> + * of fields not initialized explicitly.
> + */
> +
> +static void init_beancounter_struct(struct beancounter *bc, bcid_t id)
> +{
> + atomic_set(&bc->bc_refcount, 1);
> + spin_lock_init(&bc->bc_lock);
> + bc->bc_id = id;
> +}
> +
> +static void init_beancounter_nolimits(struct beancounter *bc)
> +{
> + int k;
```

```

> +
> + for (k = 0; k < BC_RESOURCES; k++) {
> + bc->bc_parms[k].limit = BC_MAXVALUE;
> + bc->bc_parms[k].barrier = BC_MAXVALUE;
> + }
> +}
> +
> +static void init_beancounter_syslimits(struct beancounter *bc)
> +{
> + int k;
> +
> + for (k = 0; k < BC_RESOURCES; k++)
> + bc->bc_parms[k].barrier = bc->bc_parms[k].limit;
> +}
> +
> +void __init bc_init_early(void)
> +{
> + struct beancounter *bc;
> + struct hlist_head *slot;
> +
> + bc = &init_bc;
> +
> + init_beancounter_nolimits(bc);
> + init_beancounter_struct(bc, 0);
> +
> + spin_lock_init(&bc_hash_lock);
> + slot = &bc_hash[bc_hash_fn(bc->bc_id)];
> + hlist_add_head(&bc->hash, slot);
> +}
> +
> +void __init bc_init_late(void)
> +{
> + struct beancounter *bc;
> +
> + bc_cachep = kmem_cache_create("beancounters",
> + sizeof(struct beancounter),
> + 0, SLAB_HWCACHE_ALIGN|SLAB_PANIC,
> + NULL, NULL);
> +
> + bc = &default_beancounter;
> + init_beancounter_syslimits(bc);
> + init_beancounter_struct(bc, 0);
> +}
>
> -----
> Using Tomcat but need to do more? Need to support web services, security?
> Get stuff done quickly with pre-integrated technology to make your job easier
> Download IBM WebSphere Application Server v.1.0.1 based on Apache Geronimo

```

> http://sel.as-us.falkag.net/sel?cmd=lnk&kid=120709&b id=263057&dat=121642  
>  
> ckrm-tech mailing list  
> https://lists.sourceforge.net/lists/listinfo/ckrm-tech  
--

-----  
Chandra Seetharaman | Be careful what you choose....  
- sekharan@us.ibm.com | .....you may get it.  
-----

---

Subject: Re: [ckrm-tech] [PATCH 4/7] BC: context inheriting and changing  
Posted by [Chandra Seetharaman](#) on Wed, 30 Aug 2006 19:11:32 GMT  
[View Forum Message](#) <> [Reply to Message](#)

---

On Tue, 2006-08-29 at 18:54 +0400, Kirill Korotaev wrote:

> Contains code responsible for setting BC on task,  
> it's inheriting and setting host context in interrupts.

>  
> Task references 2 beancounters:  
> 1. exec\_bc: current context. all resources are  
> charged to this beancounter.  
> 3. fork\_bc: beancounter which is inherited by  
> task's children on fork

>  
> Signed-off-by: Pavel Emelianov <xemul@sw.ru>  
> Signed-off-by: Kirill Korotaev <dev@sw.ru>

>  
> ---  
>  
> include/bc/task.h | 59 +++  
> include/linux/sched.h | 5 ++++  
> kernel/bc/Makefile | 1  
> kernel/bc/beancounter.c | 3 ++  
> kernel/bc/misc.c | 32 +++++++++++++++++++++++++++++++++++++  
> kernel/fork.c | 17 ++++++++  
> kernel/irq/handle.c | 9 ++++++  
> kernel/softirq.c | 8 ++++++  
> 8 files changed, 132 insertions(+), 2 deletions(-)

>  
> --- /dev/null 2006-07-18 14:52:43.075228448 +0400  
> +++ ./include/bc/task.h 2006-08-28 12:54:48.000000000 +0400  
> @@ -0,0 +1,59 @@  
> +/\*  
> + \* include/bc/task.h  
> + \*  
> + \* Copyright (C) 2006 OpenVZ. SWsoft Inc

```

> + *
> + */
> +
> + #ifndef __BC_TASK_H_
> + #define __BC_TASK_H_
> +
> + struct beancounter;

```

we can as well include beancounter.h here and avoid including it in different files below.

```

> +
> + struct task_beancounter {
> + struct beancounter *exec_bc;
> + struct beancounter *fork_bc;
> +};
> +
> + #ifdef CONFIG_BEANCOUNTERS
> +
> + #define get_exec_bc() (current->task_bc.exec_bc)
> + #define set_exec_bc(new) \
> + ({ \
> + struct beancounter *old; \
> + struct task_beancounter *tbc; \
> + tbc = &current->task_bc; \
> + old = tbc->exec_bc; \
> + tbc->exec_bc = new; \
> + old; \
> + })
> + #define reset_exec_bc(old, exp) \
> + do { \
> + struct task_beancounter *tbc; \
> + tbc = &current->task_bc; \
> + BUG_ON(tbc->exec_bc != exp); \
> + tbc->exec_bc = old; \
> + } while (0)
> +

```

Didn't follow why the above two macros can't be functions.

```

> + int __must_check bc_task_charge(struct task_struct *parent,
> + struct task_struct *new);
> + void bc_task_uncharge(struct task_struct *tsk);
> +
> + #else
> +
> + #define get_exec_bc() (NULL)
> + #define set_exec_bc(new) (NULL)

```

```

> +#define reset_exec_bc(new, exp) do { } while (0)
> +
> +static inline __must_check int bc_task_charge(struct task_struct *parent,
> + struct task_struct *new)
> +{
> + return 0;
> +}
> +
> +static inline void bc_task_uncharge(struct task_struct *tsk)
> +{
> +}
> +
> +#endif
> +#endif
> --- ./include/linux/sched.h.bctask 2006-08-28 12:20:13.000000000 +0400
> +++ ./include/linux/sched.h 2006-08-28 12:52:11.000000000 +0400
> @@ -83,6 +83,8 @@ struct sched_param {
> #include <linux/timer.h>
> #include <linux/hrtimer.h>
>
> +#include <bc/task.h>
> +
> #include <asm/processor.h>
>
> struct exec_domain;
> @@ -1048,6 +1050,9 @@ struct task_struct {
> spinlock_t delays_lock;
> struct task_delay_info *delays;
> #endif
> +#ifdef CONFIG_BEANCOUNTERS
> + struct task_beancounter task_bc;
> +#endif
> };
>
> static inline pid_t process_group(struct task_struct *tsk)
> --- ./kernel/bc/Makefile.bctask 2006-08-28 12:43:34.000000000 +0400
> +++ ./kernel/bc/Makefile 2006-08-28 12:52:11.000000000 +0400
> @@ -5,3 +5,4 @@
> #
>
> obj-$(CONFIG_BEANCOUNTERS) += beancounter.o
> +obj-$(CONFIG_BEANCOUNTERS) += misc.o
> --- ./kernel/bc/beancounter.c.bctask 2006-08-28 12:49:07.000000000 +0400
> +++ ./kernel/bc/beancounter.c 2006-08-28 12:52:11.000000000 +0400
> @@ -238,6 +238,9 @@ void __init bc_init_early(void)
> spin_lock_init(&bc_hash_lock);
> slot = &bc_hash[bc_hash_fn(bc->bc_id)];
> hlist_add_head(&bc->hash, slot);

```



```

> +
> + current->task_bc.exec_bc = get_beancounter(bc);
> + current->task_bc.fork_bc = get_beancounter(bc);
> }
>
> void __init bc_init_late(void)
> --- /dev/null 2006-07-18 14:52:43.075228448 +0400
> +++ ./kernel/bc/misc.c 2006-08-28 12:52:11.000000000 +0400
> @@ -0,0 +1,32 @@
> +/*
> + * kernel/bc/misc.c
> + *
> + * Copyright (C) 2006 OpenVZ. SWsoft Inc.
> + *
> + */
> +
> +
> + #include <linux/sched.h>
> +
> + #include <bc/beancounter.h>
> + #include <bc/task.h>

```

task.h is included via sched.h, not needed here.

```

> +
> + int bc_task_charge(struct task_struct *parent, struct task_struct *new)
> + {
> +     struct task_beancounter *old_bc;
> +     struct task_beancounter *new_bc;
> +     struct beancounter *bc;
> +
> +     old_bc = &parent->task_bc;
> +     new_bc = &new->task_bc;
> +
> +     bc = old_bc->fork_bc;
> +     new_bc->exec_bc = get_beancounter(bc);
> +     new_bc->fork_bc = get_beancounter(bc);
> +     return 0;
> + }

```

There is no failures, why not return void ?

```

> +
> + void bc_task_uncharge(struct task_struct *tsk)
> + {
> +     put_beancounter(tsk->task_bc.exec_bc);
> +     put_beancounter(tsk->task_bc.fork_bc);
> + }
> --- ./kernel/fork.c.bctask 2006-08-28 12:20:13.000000000 +0400
> +++ ./kernel/fork.c 2006-08-28 12:52:11.000000000 +0400

```

```

> @@ -49,6 +49,8 @@
> #include <linux/taskstats_kern.h>
> #include <linux/random.h>
>
> +#include <bc/task.h>
> +

```

not needed as already included in sched.h

```

> #include <asm/pgtable.h>
> #include <asm/pgalloc.h>
> #include <asm/uaccess.h>
> @@ -103,12 +105,18 @@ kmem_cache_t *vm_area_cachep;
> /* SLAB cache for mm_struct structures (tsk->mm) */
> static kmem_cache_t *mm_cachep;
>
> -void free_task(struct task_struct *tsk)
> +static void __free_task(struct task_struct *tsk)
> {
> free_thread_info(tsk->thread_info);
> rt_mutex_debug_task_free(tsk);
> free_task_struct(tsk);
> }
> +
> +void free_task(struct task_struct *tsk)
> +{
> + bc_task_uncharge(tsk);
> + __free_task(tsk);
> +}
> EXPORT_SYMBOL(free_task);
>
> void __put_task_struct(struct task_struct *tsk)
> @@ -983,6 +991,9 @@ static struct task_struct *copy_process(
> if (!p)
> goto fork_out;
>
> + if (bc_task_charge(current, p))
> + goto bad_charge;
> +
> #ifdef CONFIG_TRACE_IRQFLAGS
> DEBUG_LOCKS_WARN_ON(!p->hardirqs_enabled);
> DEBUG_LOCKS_WARN_ON(!p->softirqs_enabled);
> @@ -1293,7 +1304,9 @@ bad_fork_cleanup_count:
> atomic_dec(&p->user->processes);
> free_uid(p->user);
> bad_fork_free:
> - free_task(p);
> + bc_task_uncharge(p);

```

```

> +bad_charge:
> + __free_task(p);
> fork_out:
> return ERR_PTR(retval);
> }
> --- ./kernel/irq/handle.c.bctask 2006-07-10 12:39:20.000000000 +0400
> +++ ./kernel/irq/handle.c 2006-08-28 12:52:11.000000000 +0400
> @@ -16,6 +16,9 @@
> #include <linux/interrupt.h>
> #include <linux/kernel_stat.h>
>
> +#include <bc/beancounter.h>
> +#include <bc/task.h>

```

same here

```

> +
> #include "internals.h"
>
> /**
> @@ -166,6 +169,9 @@ fastcall unsigned int __do_IRQ(unsigned
> struct irq_desc *desc = irq_desc + irq;
> struct irqaction *action;
> unsigned int status;
> + struct beancounter *bc;
> +
> + bc = set_exec_bc(&init_bc);
>
> kstat_this_cpu.irqs[irq]++;
> if (CHECK_IRQ_PER_CPU(desc->status)) {
> @@ -178,6 +184,8 @@ fastcall unsigned int __do_IRQ(unsigned
> desc->chip->ack(irq);
> action_ret = handle_IRQ_event(irq, regs, desc->action);
> desc->chip->end(irq);
> +
> + reset_exec_bc(bc, &init_bc);
> return 1;
> }
>
> @@ -246,6 +254,7 @@ out:
> desc->chip->end(irq);
> spin_unlock(&desc->lock);
>
> + reset_exec_bc(bc, &init_bc);
> return 1;
> }
>
> --- ./kernel/softirq.c.bctask 2006-08-28 12:20:13.000000000 +0400
> +++ ./kernel/softirq.c 2006-08-28 12:52:11.000000000 +0400

```

```
> @@ -18,6 +18,9 @@
> #include <linux/rcupdate.h>
> #include <linux/smp.h>
>
> +#include <bc/beancounter.h>
> +#include <bc/task.h>
```

same here

```
> +
> #include <asm/irq.h>
> /*
>  - No shared variables, all the data are CPU local.
> @@ -209,6 +212,9 @@ asmlinkage void __do_softirq(void)
> __u32 pending;
> int max_restart = MAX_SOFTIRQ_RESTART;
> int cpu;
> + struct beancounter *bc;
> +
> + bc = set_exec_bc(&init_bc);
>
> pending = local_softirq_pending();
> account_system_vtime(current);
> @@ -247,6 +253,8 @@ restart:
>
> account_system_vtime(current);
> _local_bh_enable();
> +
> + reset_exec_bc(bc, &init_bc);
> }
>
> #ifndef __ARCH_HAS_DO_SOFTIRQ
>
> -----
> Using Tomcat but need to do more? Need to support web services, security?
> Get stuff done quickly with pre-integrated technology to make your job easier
> Download IBM WebSphere Application Server v.1.0.1 based on Apache Geronimo
> http://sel.as-us.falkag.net/sel?cmd=lnk&kid=120709&b id=263057&dat=121642
>
> -----
> ckrm-tech mailing list
> https://lists.sourceforge.net/lists/listinfo/ckrm-tech
--
```

```
-----
Chandra Seetharaman      | Be careful what you choose....
- sekharan@us.ibm.com   | .....you may get it.
-----
```

Subject: Re: [ckrm-tech] [PATCH 5/7] BC: user interface (syscalls)  
Posted by [Chandra Seetharaman](#) on Wed, 30 Aug 2006 19:15:23 GMT  
[View Forum Message](#) <> [Reply to Message](#)

---

On Tue, 2006-08-29 at 18:55 +0400, Kirill Korotaev wrote:

- > Add the following system calls for BC management:
- > 1. sys\_get\_bcid - get current BC id
- > 2. sys\_set\_bcid - change exec\_ and fork\_ BCs on current
- > 3. sys\_set\_bclimit - set limits for resources consumptions
- > 4. sys\_get\_bcstat - return br\_resource\_parm on resource

>  
> Signed-off-by: Pavel Emelianov <xemul@sw.ru>  
> Signed-off-by: Kirill Korotaev <dev@sw.ru>

>  
> ---  
<snip>

```
> +
> +asmlinkage long sys_set_bclimit(bcid_t id, unsigned long resource,
> + unsigned long __user *limits)
> +{
> + int error;
> + unsigned long flags;
> + struct beancounter *bc;
> + unsigned long new_limits[2];
> +
> + error = -EPERM;
> + if(!capable(CAP_SYS_RESOURCE))
> + goto out;
> +
> + error = -EINVAL;
> + if (resource >= BC_RESOURCES)
> + goto out;
> +
> + error = -EFAULT;
> + if (copy_from_user(&new_limits, limits, sizeof(new_limits)))
> + goto out;
> +
> + error = -EINVAL;
> + if (new_limits[0] > BC_MAXVALUE || new_limits[1] > BC_MAXVALUE ||
> + new_limits[0] > new_limits[1])
> + goto out;
> +
> + error = -ENOENT;
> + bc = beancounter_findcreate(id, BC_LOOKUP);
> + if (bc == NULL)
> + goto out;
```

Moving this to be before copy\_from\_user() would be efficient.

```
> +
> + spin_lock_irqsave(&bc->bc_lock, flags);
> + bc->bc_parms[resource].barrier = new_limits[0];
> + bc->bc_parms[resource].limit = new_limits[1];
> + spin_unlock_irqrestore(&bc->bc_lock, flags);
> +
> + put_beancounter(bc);
> + error = 0;
> +out:
> + return error;
> +}
<snip>
--
```

```
-----
Chandra Seetharaman      | Be careful what you choose....
- sekharan@us.ibm.com   | .....you may get it.
-----
```

---

Subject: Re: [ckrm-tech] [PATCH 6/7] BC: kernel memory (core)  
Posted by [Chandra Seetharaman](#) on Wed, 30 Aug 2006 19:25:26 GMT  
[View Forum Message](#) <> [Reply to Message](#)

---

On Tue, 2006-08-29 at 18:58 +0400, Kirill Korotaev wrote:

```
> --- ./include/bc/beancounter.h.bckmem 2006-08-28 12:47:52.000000000 +0400
> +++ ./include/bc/beancounter.h 2006-08-28 12:59:28.000000000 +0400
> @@ -12,7 +12,9 @@
> * Resource list.
> */
>
> -#define BC_RESOURCES 0
> +#define BC_KMEMSIZE 0
> +
> +#define BC_RESOURCES 1
```

<snip>

```
> --- ./kernel/bc/beancounter.c.bckmem 2006-08-28 12:52:11.000000000 +0400
> +++ ./kernel/bc/beancounter.c 2006-08-28 12:59:28.000000000 +0400
> @@ -20,6 +20,7 @@ static void init_beancounter_struct(stru
> struct beancounter init_bc;
>
> const char *bc_rnames[] = {
> + "kmemsize", /* 0 */
> };
>
> static struct hlist_head bc_hash[BC_HASH_SIZE];
```

```
> @@ -221,6 +222,8 @@ static void init_beancounter_syslimits(s
> {
> int k;
>
> + bc->bc_parms[BC_KMEMSIZE].limit = 32 * 1024 * 1024;
> +
> for (k = 0; k < BC_RESOURCES; k++)
> bc->bc_parms[k].barrier = bc->bc_parms[k].limit;
> }
```

As I mentioned in one of my earlier email

( <http://marc.theaimsgroup.com/?l=linux-kernel&m=115619384500289&w=2>),  
IMHO, this way of defining an interface is not clean/clear (for  
controller writers).

<snip>

--

-----  
Chandra Seetharaman | Be careful what you choose....  
- sekharan@us.ibm.com | .....you may get it.  
-----

---

Subject: Re: [ckrm-tech] [PATCH 3/7] BC: beancounters core (API)  
Posted by [Andrew Morton](#) on Wed, 30 Aug 2006 19:47:52 GMT  
[View Forum Message](#) <> [Reply to Message](#)

On Wed, 30 Aug 2006 11:58:34 -0700  
Chandra Seetharaman <sekharan@us.ibm.com> wrote:

```
> > +void bc_uncharge_locked(struct beancounter *bc, int res, unsigned long val);
> > +void bc_uncharge(struct beancounter *bc, int res, unsigned long val);
> > +
> > +struct beancounter *beancounter_findcreate(bcid_t id, int mask);
>
> prototype do not need the parameter names, types would suffice (would
> save you few characters).
```

argh. Those few characters are useful.

---

Subject: Re: [PATCH 1/7] introduce atomic\_dec\_and\_lock\_irqsave()  
Posted by [paulmck](#) on Thu, 31 Aug 2006 22:58:28 GMT  
[View Forum Message](#) <> [Reply to Message](#)

On Wed, Aug 30, 2006 at 07:25:07PM +0200, Roman Zippel wrote:

> Hi,  
>  
> On Wed, 30 Aug 2006, Dipankar Sarma wrote:  
>  
>>> uidhash\_lock can be taken from irq context. For example, delayed\_put\_task\_struct()  
>>> does \_\_put\_task\_struct()->free\_uid().  
>>>  
>>> AFAICT it's called via rcu, does that mean anything released via rcu has  
>>> to be protected against interrupts?  
>>  
>> No. You need protection only if you have are using some  
>> data that can also be used by the RCU callback. For example,  
>> if your RCU callback just calls kfree(), you don't have to  
>> do a spin\_lock\_bh().  
>  
> In this case kfree() does its own interrupt synchronization. I didn't  
> realize before that rcu had this (IMO serious) limitation. I think there  
> should be two call\_rcu() variants, one that queues the callback in a soft  
> irq and a second which queues it in a thread context.

How about just using synchronize\_rcu() in the second situation?  
This primitive blocks until the grace period completes, allowing you to  
do the remaining processing in thread context. As a bonus, RCU code  
that uses synchronize\_rcu() is usually quite a bit simpler than code  
using call\_rcu().

Using synchronize\_rcu():

```
list_del_rcu(p);
synchronize_rcu();
kfree(p);
```

Using call\_rcu():

```
static void rcu_callback_func(struct rcu_head *rcu)
{
    struct foo *p = container_of(rcu, struct foo, rcu);

    kfree(p);
}

list_del_rcu(p);
call_rcu(&p->rcu, rcu_callback_func);
```

Furthermore, the call\_rcu() approach requires a struct rcu\_head somewhere  
in the data structure, so use of synchronize\_rcu() saves a bit of memory,  
as well.



But if you have a situation where neither `synchronize_srcu()` nor `call_rcu()` is working out for you, let's hear it!

Thanx, Paul

---

---

Subject: Re: [PATCH 6/7] BC: kernel memory (core)

Posted by [dev](#) on Mon, 04 Sep 2006 12:19:10 GMT

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---

Balbir Singh wrote:

> Kirill Korotaev wrote:

>

>> Introduce BC\_KMEMSIZE resource which accounts kernel

>> objects allocated by task's request.

>>

>> Reference to BC is kept on struct page or slab object.

>> For slabs each struct slab contains a set of pointers

>> corresponding objects are charged to.

>>

>> Allocation charge rules:

>> 1. Pages - if allocation is performed with `__GFP_BC` flag - page

>> is charged to current's `exec_bc`.

>> 2. Slabs - `kmem_cache` may be created with `SLAB_BC` flag - in this

>> case each allocation is charged. Caches used by `kmalloc` are

>> created with `SLAB_BC | SLAB_BC_NOCHARGE` flags. In this case

>> only `__GFP_BC` allocations are charged.

>>

>

> <snip>

>

>> `+#define __GFP_BC_LIMIT ((__force gfp_t)0x100000u) /* Charge against`

>> `BC limit */`

>>

>

> What's `__GFP_BC_LIMIT` for, could you add the description for that flag?

> The comment is not very clear

>

>> `+#ifdef CONFIG_BEANCOUNTERS`

>> `+ union {`

>> `+ struct beancounter *page_bc;`

>> `+ } bc;`

>> `+#endif`

>> `};`

>>

>> `+#define page_bc(page) ((page)->bc.page_bc)`

>

>

> Minor comment - page->(bc).page\_bc has too many repetitions of page and  
> bc - see  
> the Practice of Programming by Kernighan and Pike  
>  
> I missed the part of why you wanted to have a union (in struct page for  
> bc)?  
because this union is used both for kernel memory accounting and user memory tracking.

```
>> const char *bc_rnames[] = {  
>> + "kmemsize", /* 0 */  
>> };  
>>  
>> static struct hlist_head bc_hash[BC_HASH_SIZE];  
>> @@ -221,6 +222,8 @@ static void init_beancounter_syslimits(s  
>> { int k;  
>>  
>> + bc->bc_parms[BC_KMEMSIZE].limit = 32 * 1024 * 1024;  
>> +  
>  
>
```

> Can't this be configurable CONFIG\_XXX or a #defined constant?  
This is some arbitrary limited container, just to make sure it is not  
created unlimited. User space should initialize limits properly after creation  
anyway. So I don't see reasons to make it configurable, do you?

```
>> --- ./mm/mempool.c.bckmem 2006-04-21 11:59:36.000000000 +0400  
>> +++ ./mm/mempool.c 2006-08-28 12:59:28.000000000 +0400  
>> @@ -119,6 +119,7 @@ int mempool_resize(mempool_t *pool, int  
>> unsigned long flags;  
>>  
>> BUG_ON(new_min_nr <= 0);  
>> + gfp_mask &= ~__GFP_BC;  
>>  
>> spin_lock_irqsave(&pool->lock, flags);  
>> if (new_min_nr <= pool->min_nr) {  
>> @@ -212,6 +213,7 @@ void * mempool_alloc(mempool_t *pool, gf  
>> gfp_mask |= __GFP_NOMEMALLOC; /* don't allocate emergency  
>> reserves */  
>> gfp_mask |= __GFP_NORETRY; /* don't loop in __alloc_pages */  
>> gfp_mask |= __GFP_NOWARN; /* failures are OK */  
>> + gfp_mask &= ~__GFP_BC; /* do not charge */  
>>  
>> gfp_temp = gfp_mask & ~(__GFP_WAIT|__GFP_IO);  
>>  
>
```

> Is there any reason why mempool\_xxxx() functions are not charged? Is it  
> because  
> mempool functions are mostly used from the I/O path?

yep.

```
>> --- ./mm/page_alloc.c.bckmem 2006-08-28 12:20:13.000000000 +0400
>> +++ ./mm/page_alloc.c 2006-08-28 12:59:28.000000000 +0400
>> @@ -40,6 +40,8 @@
>> #include <linux/sort.h>
>> #include <linux/pfn.h>
>>
>> +#include <bc/kmem.h>
>> +
>> #include <asm/tlbflush.h>
>> #include <asm/div64.h>
>> #include "internal.h"
>> @@ -516,6 +518,8 @@ static void __free_pages_ok(struct page  if
>> (reserved)
>>     return;
>>
>> + bc_page_uncharge(page, order);
>> +
>>     kernel_map_pages(page, 1 << order, 0);
>>     local_irq_save(flags);
>>     __count_vm_events(PGFREE, 1 << order);
>> @@ -799,6 +803,8 @@ static void fastcall free_hot_cold_page(
>>     if (free_pages_check(page))
>>         return;
>>
>> + bc_page_uncharge(page, 0);
>> +
>>     kernel_map_pages(page, 1, 0);
>>
>>     pcp = &zone_pcp(zone, get_cpu()->pcp[cold];
>> @@ -1188,6 +1194,11 @@ nopage:
>>     show_mem();
>> }
>> got_pg:
>> + if ((gfp_mask & __GFP_BC) &&
>> +     bc_page_charge(page, order, gfp_mask)) {
>
>
> I wonder if bc_page_charge() should be called bc_page_charge_failed()?
> Does it make sense to atleast partially start reclamation here? I know with
> bean counters we cannot reclaim from a particular container, but for now
> we could kick off kswapd() or call shrink_all_memory() inline (Dave's
> patches do this to shrink memory from the particular cpuset). Or do you
> want to leave this
> slot open for later?
yes. my intention is to account correctly all needed information first.
After we agree on accounting, we can agree on how to do reclamation.
```

```
>> +   __free_pages(page, order);
>> +   page = NULL;
>> +   }
>
>
>
```

---

---

Subject: Re: [ckrm-tech] [PATCH 6/7] BC: kernel memory (core)  
Posted by [dev](#) on Mon, 04 Sep 2006 12:20:00 GMT  
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---

Dave Hansen wrote:

> On Tue, 2006-08-29 at 18:58 +0400, Kirill Korotaev wrote:

```
>
>>@@ -274,8 +274,14 @@ struct page {
>>   unsigned int gfp_mask;
>>   unsigned long trace[8];
>> #endif
>>+#ifdef CONFIG_BEANCOUNTERS
>>+   union {
>>+       struct beancounter   *page_bc;
>>+   } bc;
>>+#endif
>> };
```

> I know you're probably saving this union for when you put some userspace  
> stuff in here or something. But, for now, it would probably be best  
> just to leave it as a plain struct, or even an anonymous union.

> You probably had to use gcc 2 when this was written and couldn't use  
> anonymous unions, right?

are you suggesting the code like this:

```
>>+#ifdef CONFIG_BEANCOUNTERS
>>+   union {
>>+       struct beancounter   *page_bc;
>>+   };
>>+#endif
>> };
```

```
#define page_bc(page) ((page)->page_bc)
?
```

> -- Dave

```
>
>
```

> -----  
> Using Tomcat but need to do more? Need to support web services, security?  
> Get stuff done quickly with pre-integrated technology to make your job easier  
> Download IBM WebSphere Application Server v.1.0.1 based on Apache Geronimo  
> <http://sel.as-us.falkag.net/sel?cmd=lnk&kid=120709&b id=263057&dat=121642>  
> -----  
> ckrm-tech mailing list  
> <https://lists.sourceforge.net/lists/listinfo/ckrm-tech>  
>

---

---

Subject: Re: [PATCH 6/7] BC: kernel memory (core)  
Posted by [Balbir Singh](#) on Mon, 04 Sep 2006 15:45:47 GMT  
[View Forum Message](#) <> [Reply to Message](#)

---

Kirill Korotaev wrote:

> Balbir Singh wrote:

>> Kirill Korotaev wrote:

```
>>> #ifdef CONFIG_BEANCOUNTERS
>>> + union {
>>> +     struct beancounter  *page_bc;
>>> + } bc;
>>> #endif
>>> };
>>>
>>> #define page_bc(page)      ((page)->bc.page_bc)
>>
>>
>> Minor comment - page->(bc).page_bc has too many repetitions of page
>> and bc - see
>> the Practice of Programming by Kernighan and Pike
>>
>> I missed the part of why you wanted to have a union (in struct page
>> for bc)?
> because this union is used both for kernel memory accounting and user
> memory tracking.
```

Ok.. that's good. I remember seeing a user\_bc sometime back in the code.  
I had some idea about allowing tasks to migrate across resources (bean  
counters), which I think can be easily done for user space pages, if the  
user limits are tracked separately.

```
>
>>> const char *bc_rnames[] = {
>>> + "kmemsize", /* 0 */
>>> };
>>>
```

```
>>> static struct hlist_head bc_hash[BC_HASH_SIZE];
>>> @@ -221,6 +222,8 @@ static void init_beancounter_syslimits(s
>>> {   int k;
>>>
>>> +   bc->bc_parms[BC_KMEMSIZE].limit = 32 * 1024 * 1024;
>>> +
>>
>>
>> Can't this be configurable CONFIG_XXX or a #defined constant?
> This is some arbitrary limited container, just to make sure it is not
> created unlimited. User space should initialize limits properly after
> creation
> anyway. So I don't see reasons to make it configurable, do you?
```

May be its not very important now but configurable limits will help a confused user. Even if we decide to use this number for now, a constant like BC\_DEFAULT\_MEM\_LIMIT is easier to read.

```
>> I wonder if bc_page_charge() should be called bc_page_charge_failed()?
>> Does it make sense to atleast partially start reclamation here? I know
>> with
>> bean counters we cannot reclaim from a particular container, but for now
>> we could kick off kswapd() or call shrink_all_memory() inline (Dave's
>> patches do this to shrink memory from the particular cpuset). Or do
>> you want to leave this
>> slot open for later?
> yes. my intention is to account correctly all needed information first.
> After we agree on accounting, we can agree on how to do reclamation.
>
```

That sounds like a good plan.

--

Balbir Singh,  
Linux Technology Center,  
IBM Software Labs

---

Subject: Re: [ckrm-tech] [PATCH 6/7] BC: kernel memory (core)  
Posted by [Dave Hansen](#) on Tue, 05 Sep 2006 16:21:34 GMT  
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---

On Mon, 2006-09-04 at 16:23 +0400, Kirill Korotaev wrote:

```
>
> are you suggesting the code like this:
> >>+#ifdef CONFIG_BEANCOUNTERS
> >>+   union {
```

```
> >>+      struct beancounter    *page_bc;
> >>+      };
> >>+ #endif
> >> };
>
> #define page_bc(page) ((page)->page_bc)
```

That would be a bit better. Although, I think the "page\_" bit is also superfluous.

-- Dave

---