
Subject: [PATCH v7 3/8] foundations of per-cgroup memory pressure controlling.
Posted by [Glauber Costa](#) on Thu, 13 Oct 2011 13:09:37 GMT
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This patch converts struct sock fields memory_pressure, memory_allocated, sockets_allocated, and sysctl_mem (now prot_mem) to function pointers, receiving a struct mem_cgroup parameter.

enter_memory_pressure is kept the same, since all its callers have socket a context, and the kmem_cgroup can be derived from the socket itself.

To keep things working, the patch convert all users of those fields to use accessor functions.

In my benchmarks I didn't see a significant performance difference with this patch applied compared to a baseline (around 1 % diff, thus inside error margin).

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```
crypto/af_alg.c      |  8 +++-
include/linux/memcontrol.h | 22 +++++++-
include/net/sock.h    | 114 ++++++++++++++++++++++++++++++++++++++
include/net/tcp.h     | 12 +++-
include/net/udp.h     |  4 +-
include/trace/events/sock.h | 10 +++-
mm/memcontrol.c       | 19 +++++-
net/core/sock.c       | 62 ++++++++-----
net/deccnet/af_deccnet.c | 22 ++++++-
net/ipv4/proc.c       |  7 +-
net/ipv4/tcp.c        | 28 ++++++-
net/ipv4/tcp_input.c  | 12 +++-
net/ipv4/tcp_ipv4.c   | 12 +++-
net/ipv4/tcp_output.c |  2 +-
net/ipv4/tcp_timer.c  |  2 +-
net/ipv4/udp.c        | 21 ++++++-
net/ipv6/tcp_ipv6.c   | 10 +++-
net/ipv6/udp.c        |  4 +-
net/sctp/socket.c     | 37 ++++++++-----
19 files changed, 320 insertions(+), 88 deletions(-)
```

```
diff --git a/crypto/af_alg.c b/crypto/af_alg.c
index ac33d5f..09cdf11 100644
--- a/crypto/af_alg.c
```

```

+++ b/crypto/af_alg.c
@@ -29,10 +29,16 @@ struct alg_type_list {

static atomic_long_t alg_memory_allocated;

+static long memory_allocated_alg(struct mem_cgroup *memcg, long val,
+ int *parent_status)
+{
+ return atomic_long_add_return(val, &alg_memory_allocated);
+}
+
static struct proto alg_proto = {
    .name = "ALG",
    .owner = THIS_MODULE,
- .memory_allocated = &alg_memory_allocated,
+ .mem_allocated_add = memory_allocated_alg,
    .obj_size = sizeof(struct alg_sock),
};

diff --git a/include/linux/memcontrol.h b/include/linux/memcontrol.h
index 88aea1b..99a8ba2 100644
--- a/include/linux/memcontrol.h
+++ b/include/linux/memcontrol.h
@@ -361,6 +361,10 @@ static inline
void mem_cgroup_count_vm_event(struct mm_struct *mm, enum vm_event_item idx)
{
}
+static inline struct mem_cgroup *mem_cgroup_from_task(struct task_struct *p)
+{
+ return NULL;
+}
#endif /* CONFIG_CGROUP_MEM_CONT */

#if !defined(CONFIG_CGROUP_MEM_RES_CTLR) || !defined(CONFIG_DEBUG_VM)
@@ -377,12 +381,28 @@ mem_cgroup_print_bad_page(struct page *page)
#endif

#ifdef CONFIG_INET
+enum {
+ UNDER_LIMIT,
+ OVER_LIMIT,
+};
+
struct sock;
+struct proto;
#ifdef CONFIG_CGROUP_MEM_RES_CTLR_KMEM
void sock_update_memcg(struct sock *sk);
void sock_release_memcg(struct sock *sk);

```

```

-
+void memcg_sockets_allocated_dec(struct mem_cgroup *memcg, struct proto *prot);
+void memcg_sockets_allocated_inc(struct mem_cgroup *memcg, struct proto *prot);
+else
+/* memcontrol includes sockets.h, that includes memcontrol.h ... */
+static inline void memcg_sockets_allocated_dec(struct mem_cgroup *memcg,
+        struct proto *prot)
+{
+}
+static inline void memcg_sockets_allocated_inc(struct mem_cgroup *memcg,
+        struct proto *prot)
+{
+}
+static inline void sock_update_memcg(struct sock *sk)
+{
+}
diff --git a/include/net/sock.h b/include/net/sock.h
index afe1467..163f87b 100644
--- a/include/net/sock.h
+++ b/include/net/sock.h
@@ -54,6 +54,7 @@
#include <linux/security.h>
#include <linux/slab.h>
#include <linux/uaccess.h>
+#include <linux/cgroup.h>

#include <linux/filter.h>
#include <linux/rculist_nulls.h>
@@ -168,6 +169,8 @@ struct sock_common {
/* public: */
};

+struct mem_cgroup;
+
+/**
+ * struct sock - network layer representation of sockets
+ * @__sk_common: shared layout with inet_timewait_sock
@@ -786,18 +789,36 @@ struct proto {
unsigned int inuse_idx;
#endif

+ /*
+ * per-cgroup memory tracking:
+ *
+ * The following functions track memory consumption of network buffers
+ * by cgroup (kmem_cgroup) for the current protocol. As of the rest
+ * of the fields in this structure, not all protocols are required
+ * to implement them. Protocols that don't want to do per-cgroup

```

```

+ * memory pressure management, can just assume the root cgroup is used.
+ *
+ */
+ /* Memory pressure */
+ void (*enter_memory_pressure)(struct sock *sk);
+ atomic_long_t *memory_allocated; /* Current allocated memory. */
+ struct percpu_counter *sockets_allocated; /* Current number of sockets. */
+ /*
+  * Pressure flag: try to collapse.
+  * Add a value in pages to the current memory allocation,
+  * and return the current value.
+  */
+ long (*mem_allocated_add)(struct mem_cgroup *memcg,
+ long val, int *parent_status);
+ /* Pointer to the current number of sockets in this cgroup. */
+ struct percpu_counter *(*sockets_allocated)(const struct mem_cgroup *memcg);
+ /*
+  * Per cgroup pointer to the pressure flag: try to collapse.
+  * Technical note: it is used by multiple contexts non atomically.
+  * All the __sk_mem_schedule() is of this nature: accounting
+  * is strict, actions are advisory and have some latency.
+  */
+ int *memory_pressure;
+ long *sysctl_mem;
+ int *(*memory_pressure)(const struct mem_cgroup *memcg);
+ /* Pointer to the per-cgroup version of the the sysctl_mem field */
+ long *(*prot_mem)(const struct mem_cgroup *memcg);
+
+ int *sysctl_wmem;
+ int *sysctl_rmem;
+ int max_header;
@@ -856,6 +877,87 @@ static inline void sk_refcnt_debug_release(const struct sock *sk)
#define sk_refcnt_debug_release(sk) do { } while (0)
#endif /* SOCK_REFCNT_DEBUG */

#include <linux/memcontrol.h>
static inline int *sk_memory_pressure(struct sock *sk)
+{
+ int *ret = NULL;
+ if (sk->sk_prot->memory_pressure)
+ ret = sk->sk_prot->memory_pressure(sk->sk_cgrp);
+ return ret;
+}
+
+static inline long sk_prot_mem(struct sock *sk, int index)
+{
+ long *prot = sk->sk_prot->prot_mem(sk->sk_cgrp);
+ return prot[index];

```

```

+}
+
+static inline long
+sk_memory_allocated(struct sock *sk)
+{
+ struct proto *prot = sk->sk_prot;
+ struct mem_cgroup *cg = sk->sk_cgrp;
+
+ return prot->mem_allocated_add(cg, 0, NULL);
+}
+
+static inline long
+sk_memory_allocated_add(struct sock *sk, int amt, int *parent_status)
+{
+ struct proto *prot = sk->sk_prot;
+ struct mem_cgroup *cg = sk->sk_cgrp;
+
+ return prot->mem_allocated_add(cg, amt, parent_status);
+}
+
+static inline void
+sk_memory_allocated_sub(struct sock *sk, int amt, int parent_status)
+{
+ struct proto *prot = sk->sk_prot;
+ struct mem_cgroup *cg = sk->sk_cgrp;
+
+ prot->mem_allocated_add(cg, -amt, &parent_status);
+}
+
+static inline void sk_sockets_allocated_dec(struct sock *sk)
+{
+ struct proto *prot = sk->sk_prot;
+ struct mem_cgroup *cg = sk->sk_cgrp;
+
+ percpu_counter_dec(prot->sockets_allocated(cg));
+ memcg_sockets_allocated_dec(cg, prot);
+}
+
+static inline void sk_sockets_allocated_inc(struct sock *sk)
+{
+ struct proto *prot = sk->sk_prot;
+ struct mem_cgroup *cg = sk->sk_cgrp;
+
+ percpu_counter_inc(prot->sockets_allocated(cg));
+ memcg_sockets_allocated_inc(cg, prot);
+}
+
+static inline int

```

```

+sk_sockets_allocated_read_positive(struct sock *sk)
+{
+ struct proto *prot = sk->sk_prot;
+ struct mem_cgroup *cg = sk->sk_cgrp;
+
+ return percpu_counter_sum_positive(prot->sockets_allocated(cg));
+}
+
+static inline int
+kcg_sockets_allocated_sum_positive(struct proto *prot, struct mem_cgroup *cg)
+{
+ return percpu_counter_sum_positive(prot->sockets_allocated(cg));
+}
+
+static inline long
+kcg_memory_allocated(struct proto *prot, struct mem_cgroup *cg)
+{
+ return prot->mem_allocated_add(cg, 0, NULL);
+}
+

```

```

#ifdef CONFIG_PROC_FS
/* Called with local bh disabled */
@@ -952,7 +1054,7 @@ static inline int sk_mem_pages(int amt)
static inline int sk_has_account(struct sock *sk)
{
/* return true if protocol supports memory accounting */
- return !!sk->sk_prot->memory_allocated;
+ return !!sk->sk_prot->mem_allocated_add;
}

```

```

static inline int sk_wmem_schedule(struct sock *sk, int size)

```

```

diff --git a/include/net/tcp.h b/include/net/tcp.h

```

```

index acc620a..eac7bf6 100644

```

```

--- a/include/net/tcp.h

```

```

+++ b/include/net/tcp.h

```

```

@@ -45,6 +45,7 @@

```

```

#include <net/dst.h>

```

```

#include <linux/seq_file.h>

```

```

#include <linux/memcontrol.h>

```

```

extern struct inet_hashinfo tcp_hashinfo;

```

```

@@ -253,9 +254,12 @@ extern int sysctl_tcp_cookie_size;

```

```

extern int sysctl_tcp_thin_linear_timeouts;

```

```

extern int sysctl_tcp_thin_dupack;

```

```

-extern atomic_long_t tcp_memory_allocated;
-extern struct percpu_counter tcp_sockets_allocated;
-extern int tcp_memory_pressure;
+struct mem_cgroup;
+extern long *tcp_sysctl_mem(const struct mem_cgroup *memcg);
+struct percpu_counter *sockets_allocated_tcp(const struct mem_cgroup *memcg);
+int *memory_pressure_tcp(const struct mem_cgroup *memcg);
+long memory_allocated_tcp_add(struct mem_cgroup *memcg, long val,
+    int *parent_status);

/*
 * The next routines deal with comparing 32 bit unsigned ints
@@ -286,7 +290,7 @@ static inline bool tcp_too_many_orphans(struct sock *sk, int shift)
}

if (sk->sk_wmem_queued > SOCK_MIN_SNDBUF &&
-    atomic_long_read(&tcp_memory_allocated) > sysctl_tcp_mem[2])
+    sk_memory_allocated(sk) > sk_prot_mem(sk, 2))
    return true;
    return false;
}
diff --git a/include/net/udp.h b/include/net/udp.h
index 67ea6fc..eecd727 100644
--- a/include/net/udp.h
+++ b/include/net/udp.h
@@ -105,7 +105,9 @@ static inline struct udp_hslot *udp_hashslot2(struct udp_table *table,

extern struct proto udp_prot;

-extern atomic_long_t udp_memory_allocated;
+long memory_allocated_udp_add(struct mem_cgroup *memcg, long val,
+    int *parent_status);
+long *udp_sysctl_mem(const struct mem_cgroup *memcg);

/* sysctl variables for udp */
extern long sysctl_udp_mem[3];
diff --git a/include/trace/events/sock.h b/include/trace/events/sock.h
index 779abb9..12a6083 100644
--- a/include/trace/events/sock.h
+++ b/include/trace/events/sock.h
@@ -37,7 +37,7 @@ TRACE_EVENT(sock_exceed_buf_limit,

TP_STRUCT__entry(
    __array(char, name, 32)
-    __field(long *, sysctl_mem)
+    __field(long *, prot_mem)
    __field(long, allocated)
    __field(int, sysctl_rmem)

```

```

__field(int, rmem_alloc)
@@ -45,7 +45,7 @@ TRACE_EVENT(sock_exceed_buf_limit,

TP_fast_assign(
    strncpy(__entry->name, prot->name, 32);
- __entry->sysctl_mem = prot->sysctl_mem;
+ __entry->prot_mem = sk->sk_prot->prot_mem(sk->sk_cgrp);
    __entry->allocated = allocated;
    __entry->sysctl_rmem = prot->sysctl_rmem[0];
    __entry->rmem_alloc = atomic_read(&sk->sk_rmem_alloc);
@@ -54,9 +54,9 @@ TRACE_EVENT(sock_exceed_buf_limit,
    TP_printk("proto:%s sysctl_mem=%ld,%ld,%ld allocated=%ld "
        "sysctl_rmem=%d rmem_alloc=%d",
        __entry->name,
- __entry->sysctl_mem[0],
- __entry->sysctl_mem[1],
- __entry->sysctl_mem[2],
+ __entry->prot_mem[0],
+ __entry->prot_mem[1],
+ __entry->prot_mem[2],
        __entry->allocated,
        __entry->sysctl_rmem,
        __entry->rmem_alloc)
diff --git a/mm/memcontrol.c b/mm/memcontrol.c
index 623841d..4e71fd8 100644
--- a/mm/memcontrol.c
+++ b/mm/memcontrol.c
@@ -376,6 +376,7 @@ enum mem_type {
#define MEM_CGROUP_RECLAIM_SOFT_BIT 0x2
#define MEM_CGROUP_RECLAIM_SOFT (1 << MEM_CGROUP_RECLAIM_SOFT_BIT)

+static struct mem_cgroup *parent_mem_cgroup(struct mem_cgroup *memcg);
/* Writing them here to avoid exposing memcg's inner layout */
#ifdef CONFIG_CGROUP_MEM_RES_CTLR_KMEM
#ifdef CONFIG_INET
@@ -409,13 +410,27 @@ void sock_release_memcg(struct sock *sk)
{
    cgroup_release_and_wakeup_rmdir(mem_cgroup_css(sk->sk_cgrp));
}
+
+void memcg_sockets_allocated_dec(struct mem_cgroup *memcg, struct proto *prot)
+{
+ memcg = parent_mem_cgroup(memcg);
+ for (; memcg; memcg = parent_mem_cgroup(memcg))
+ percpu_counter_dec(prot->sockets_allocated(memcg));
+}
+EXPORT_SYMBOL(memcg_sockets_allocated_dec);
+

```



```

+void memcg_sockets_allocated_inc(struct mem_cgroup *memcg, struct proto *prot)
+{
+ memcg = parent_mem_cgroup(memcg);
+ for (; memcg; memcg = parent_mem_cgroup(memcg))
+ percpu_counter_inc(prot->sockets_allocated(memcg));
+}
+EXPORT_SYMBOL(memcg_sockets_allocated_inc);
#endif /* CONFIG_INET */
#endif /* CONFIG_CGROUP_MEM_RES_CTLR_KMEM */

-
static void mem_cgroup_get(struct mem_cgroup *mem);
static void mem_cgroup_put(struct mem_cgroup *mem);
-static struct mem_cgroup *parent_mem_cgroup(struct mem_cgroup *mem);
static void drain_all_stock_async(struct mem_cgroup *mem);

static struct mem_cgroup_per_zone *
diff --git a/net/core/sock.c b/net/core/sock.c
index 5426ba0..22ef143 100644
--- a/net/core/sock.c
+++ b/net/core/sock.c
@@ -1293,7 +1293,7 @@ struct sock *sk_clone(const struct sock *sk, const gfp_t priority)
newsk->sk_wq = NULL;

if (newsk->sk_prot->sockets_allocated)
- percpu_counter_inc(newsk->sk_prot->sockets_allocated);
+ sk_sockets_allocated_inc(newsk);

if (sock_flag(newsk, SOCK_TIMESTAMP) ||
    sock_flag(newsk, SOCK_TIMESTAMPING_RX_SOFTWARE))
@@ -1684,30 +1684,33 @@ int __sk_mem_schedule(struct sock *sk, int size, int kind)
struct proto *prot = sk->sk_prot;
int amt = sk_mem_pages(size);
long allocated;
+ int *memory_pressure;
+ int parent_status = UNDER_LIMIT;

sk->sk_forward_alloc += amt * SK_MEM_QUANTUM;
- allocated = atomic_long_add_return(amt, prot->memory_allocated);
+
+ memory_pressure = sk_memory_pressure(sk);
+ allocated = sk_memory_allocated_add(sk, amt, &parent_status);
+
+ /* Over hard limit (we, or our parents) */
+ if ((parent_status == OVER_LIMIT) || (allocated > sk_prot_mem(sk, 2)))
+ goto suppress_allocation;

/* Under limit. */

```

```

- if (allocated <= prot->sysctl_mem[0]) {
- if (prot->memory_pressure && *prot->memory_pressure)
- *prot->memory_pressure = 0;
- return 1;
- }
+ if (allocated <= sk_prot_mem(sk, 0))
+ if (memory_pressure && *memory_pressure)
+ *memory_pressure = 0;

/* Under pressure. */
- if (allocated > prot->sysctl_mem[1])
+ if (allocated > sk_prot_mem(sk, 1))
    if (prot->enter_memory_pressure)
        prot->enter_memory_pressure(sk);

- /* Over hard limit. */
- if (allocated > prot->sysctl_mem[2])
- goto suppress_allocation;
-
/* guarantee minimum buffer size under pressure */
if (kind == SK_MEM_RECV) {
    if (atomic_read(&sk->sk_rmem_alloc) < prot->sysctl_rmem[0])
        return 1;
+
} else { /* SK_MEM_SEND */
    if (sk->sk_type == SOCK_STREAM) {
        if (sk->sk_wmem_queued < prot->sysctl_wmem[0])
@@ -1717,13 +1720,13 @@ int __sk_mem_schedule(struct sock *sk, int size, int kind)
        return 1;
    }

- if (prot->memory_pressure) {
+ if (memory_pressure) {
    int alloc;

- if (!*prot->memory_pressure)
+ if (!*memory_pressure)
        return 1;
- alloc = percpu_counter_read_positive(prot->sockets_allocated);
- if (prot->sysctl_mem[2] > alloc *
+ alloc = sk_sockets_allocated_read_positive(sk);
+ if (sk_prot_mem(sk, 2) > alloc *
        sk_mem_pages(sk->sk_wmem_queued +
        atomic_read(&sk->sk_rmem_alloc) +
        sk->sk_forward_alloc))
@@ -1746,7 +1749,9 @@ suppress_allocation:

/* Alas. Undo changes. */

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    sk->sk_forward_alloc -= amt * SK_MEM_QUANTUM;
- atomic_long_sub(amt, prot->memory_allocated);
+
+ sk_memory_allocated_sub(sk, amt, parent_status);
+
    return 0;
}
EXPORT_SYMBOL(__sk_mem_schedule);
@@ -1757,15 +1762,15 @@ EXPORT_SYMBOL(__sk_mem_schedule);
*/
void __sk_mem_reclaim(struct sock *sk)
{
- struct proto *prot = sk->sk_prot;
+ int *memory_pressure = sk_memory_pressure(sk);

- atomic_long_sub(sk->sk_forward_alloc >> SK_MEM_QUANTUM_SHIFT,
-   prot->memory_allocated);
+ sk_memory_allocated_sub(sk,
+   sk->sk_forward_alloc >> SK_MEM_QUANTUM_SHIFT, 0);
    sk->sk_forward_alloc &= SK_MEM_QUANTUM - 1;

- if (prot->memory_pressure && *prot->memory_pressure &&
-   (atomic_long_read(prot->memory_allocated) < prot->sysctl_mem[0]))
-   *prot->memory_pressure = 0;
+ if (memory_pressure && *memory_pressure &&
+   (sk_memory_allocated(sk) < sk_prot_mem(sk, 0)))
+   *memory_pressure = 0;
}
EXPORT_SYMBOL(__sk_mem_reclaim);

@@ -2484,13 +2489,20 @@ static char proto_method_implemented(const void *method)

static void proto_seq_printf(struct seq_file *seq, struct proto *proto)
{
+ struct mem_cgroup *cg = mem_cgroup_from_task(current);
+ int *memory_pressure = NULL;
+
+ if (proto->memory_pressure)
+   memory_pressure = proto->memory_pressure(cg);
+
    seq_printf(seq, "%-9s %4u %6d %6ld %-3s %6u %-3s %-10s "
      "%2c %2c %2c %2c %2c %2c %2c %2c %2c %2c %2c %2c %2c %2c %2c %2c %2c\n",
      proto->name,
      proto->obj_size,
      sock_prot_inuse_get(seq_file_net(seq), proto),
-   proto->memory_allocated != NULL ? atomic_long_read(proto->memory_allocated) : -1L,
-   proto->memory_pressure != NULL ? *proto->memory_pressure ? "yes" : "no" : "NI",

```

```

+ proto->mem_allocated_add != NULL ?
+ kcg_memory_allocated(proto, cg) : -1L,
+ memory_pressure != NULL ? *memory_pressure ? "yes" : "no" : "NI",
  proto->max_header,
  proto->slab == NULL ? "no" : "yes",
  module_name(proto->owner),
diff --git a/net/decnet/af_decnet.c b/net/decnet/af_decnet.c
index 19acd00..724ac73 100644
--- a/net/decnet/af_decnet.c
+++ b/net/decnet/af_decnet.c
@@ -458,13 +458,29 @@ static void dn_enter_memory_pressure(struct sock *sk)
 }
 }

+static long memory_allocated_dn_add(struct mem_cgroup *memcg,
+    long val, int *parent_status)
+{
+ return atomic_long_add_return(val, &decnet_memory_allocated);
+}
+
+static int *memory_pressure_dn(const struct mem_cgroup *memcg)
+{
+ return &dn_memory_pressure;
+}
+
+static long *dn_sysctl_mem(const struct mem_cgroup *memcg)
+{
+ return sysctl_decnet_mem;
+}
+
static struct proto dn_proto = {
    .name = "NSP",
    .owner = THIS_MODULE,
    .enter_memory_pressure = dn_enter_memory_pressure,
- .memory_pressure = &dn_memory_pressure,
- .memory_allocated = &decnet_memory_allocated,
- .sysctl_mem = sysctl_decnet_mem,
+ .memory_pressure = memory_pressure_dn,
+ .mem_allocated_add = memory_allocated_dn_add,
+ .prot_mem = dn_sysctl_mem,
    .sysctl_wmem = sysctl_decnet_wmem,
    .sysctl_rmem = sysctl_decnet_rmem,
    .max_header = DN_MAX_NSP_DATA_HEADER + 64,
diff --git a/net/ipv4/proc.c b/net/ipv4/proc.c
index 4bfad5d..535456d 100644
--- a/net/ipv4/proc.c
+++ b/net/ipv4/proc.c
@@ -52,20 +52,21 @@ static int sockstat_seq_show(struct seq_file *seq, void *v)

```

```

{
    struct net *net = seq->private;
    int orphans, sockets;
+ struct mem_cgroup *cg = mem_cgroup_from_task(current);

    local_bh_disable();
    orphans = percpu_counter_sum_positive(&tcp_orphan_count);
- sockets = percpu_counter_sum_positive(&tcp_sockets_allocated);
+ sockets = kcg_sockets_allocated_sum_positive(&tcp_prot, cg);
    local_bh_enable();

    socket_seq_show(seq);
    seq_printf(seq, "TCP: inuse %d orphan %d tw %d alloc %d mem %ld\n",
        sock_prot_inuse_get(net, &tcp_prot), orphans,
        tcp_death_row.tw_count, sockets,
-    atomic_long_read(&tcp_memory_allocated));
+    kcg_memory_allocated(&tcp_prot, cg));
    seq_printf(seq, "UDP: inuse %d mem %ld\n",
        sock_prot_inuse_get(net, &udp_prot),
-    atomic_long_read(&udp_memory_allocated));
+    kcg_memory_allocated(&udp_prot, cg));
    seq_printf(seq, "UDPLITE: inuse %d\n",
        sock_prot_inuse_get(net, &udplite_prot));
    seq_printf(seq, "RAW: inuse %d\n",
diff --git a/net/ipv4/tcp.c b/net/ipv4/tcp.c
index 46febca..dc8f01e 100644
--- a/net/ipv4/tcp.c
+++ b/net/ipv4/tcp.c
@@ -291,13 +291,11 @@ EXPORT_SYMBOL(sysctl_tcp_rmem);
EXPORT_SYMBOL(sysctl_tcp_wmem);

atomic_long_t tcp_memory_allocated; /* Current allocated memory. */
-EXPORT_SYMBOL(tcp_memory_allocated);

/*
 * Current number of TCP sockets.
 */
struct percpu_counter tcp_sockets_allocated;
-EXPORT_SYMBOL(tcp_sockets_allocated);

/*
 * TCP splice context
@@ -315,7 +313,18 @@ struct tcp_splice_state {
 * is strict, actions are advisory and have some latency.
 */
int tcp_memory_pressure __read_mostly;
-EXPORT_SYMBOL(tcp_memory_pressure);
+

```

```

+int *memory_pressure_tcp(const struct mem_cgroup *memcg)
+{
+ return &tcp_memory_pressure;
+}
+EXPORT_SYMBOL(memory_pressure_tcp);
+
+struct percpu_counter *sockets_allocated_tcp(const struct mem_cgroup *memcg)
+{
+ return &tcp_sockets_allocated;
+}
+EXPORT_SYMBOL(sockets_allocated_tcp);

void tcp_enter_memory_pressure(struct sock *sk)
{
@@ -326,6 +335,19 @@ void tcp_enter_memory_pressure(struct sock *sk)
}
EXPORT_SYMBOL(tcp_enter_memory_pressure);

+long *tcp_sysctl_mem(const struct mem_cgroup *memcg)
+{
+ return sysctl_tcp_mem;
+}
+EXPORT_SYMBOL(tcp_sysctl_mem);
+
+long memory_allocated_tcp_add(struct mem_cgroup *memcg, long val,
+    int *parent_status)
+{
+ return atomic_long_add_return(val, &tcp_memory_allocated);
+}
+EXPORT_SYMBOL(memory_allocated_tcp_add);
+
+/* Convert seconds to retransmits based on initial and max timeout */
static u8 secs_to_retrans(int seconds, int timeout, int rto_max)
{
diff --git a/net/ipv4/tcp_input.c b/net/ipv4/tcp_input.c
index d73aab3..87520ed 100644
--- a/net/ipv4/tcp_input.c
+++ b/net/ipv4/tcp_input.c
@@ -316,7 +316,7 @@ static void tcp_grow_window(struct sock *sk, struct sk_buff *skb)
/* Check #1 */
if (tp->rcv_ssthresh < tp->window_clamp &&
    (int)tp->rcv_ssthresh < tcp_space(sk) &&
-    !tcp_memory_pressure) {
+    !sk_memory_pressure(sk)) {
    int incr;

/* Check #2. Increase window, if skb with such overhead
@@ -398,8 +398,8 @@ static void tcp_clamp_window(struct sock *sk)

```

```

if (sk->sk_rcvbuf < sysctl_tcp_rmem[2] &&
    !(sk->sk_userlocks & SOCK_RCVBUF_LOCK) &&
- !tcp_memory_pressure &&
- atomic_long_read(&tcp_memory_allocated) < sysctl_tcp_mem[0]) {
+ !sk_memory_pressure(sk) &&
+ sk_memory_allocated(sk) < sk_prot_mem(sk, 0)) {
    sk->sk_rcvbuf = min(atomic_read(&sk->sk_rmem_alloc),
        sysctl_tcp_rmem[2]);
}
@@ -4804,7 +4804,7 @@ static int tcp_prune_queue(struct sock *sk)

if (atomic_read(&sk->sk_rmem_alloc) >= sk->sk_rcvbuf)
    tcp_clamp_window(sk);
- else if (tcp_memory_pressure)
+ else if (sk_memory_pressure(sk))
    tp->rcv_ssthresh = min(tp->rcv_ssthresh, 4U * tp->advmss);

tcp_collapse_ofo_queue(sk);
@@ -4870,11 +4870,11 @@ static int tcp_should_expand_sndbuf(struct sock *sk)
    return 0;

/* If we are under global TCP memory pressure, do not expand. */
- if (tcp_memory_pressure)
+ if (sk_memory_pressure(sk))
    return 0;

/* If we are under soft global TCP memory pressure, do not expand. */
- if (atomic_long_read(&tcp_memory_allocated) >= sysctl_tcp_mem[0])
+ if (sk_memory_allocated(sk) >= sk_prot_mem(sk, 0))
    return 0;

/* If we filled the congestion window, do not expand. */
diff --git a/net/ipv4/tcp_ipv4.c b/net/ipv4/tcp_ipv4.c
index 7963e03..7072060 100644
--- a/net/ipv4/tcp_ipv4.c
+++ b/net/ipv4/tcp_ipv4.c
@@ -1911,7 +1911,7 @@ static int tcp_v4_init_sock(struct sock *sk)
    sk->sk_rcvbuf = sysctl_tcp_rmem[1];

    local_bh_disable();
- percpu_counter_inc(&tcp_sockets_allocated);
+ sk_sockets_allocated_inc(sk);
    local_bh_enable();

    return 0;
@@ -1967,7 +1967,7 @@ void tcp_v4_destroy_sock(struct sock *sk)
    tp->cookie_values = NULL;

```

```

}

- percpu_counter_dec(&tcp_sockets_allocated);
+ sk_sockets_allocated_dec(sk);
}
EXPORT_SYMBOL(tcp_v4_destroy_sock);

@@ -2608,11 +2608,11 @@ struct proto tcp_prot = {
    .unhash = inet_unhash,
    .get_port = inet_csk_get_port,
    .enter_memory_pressure = tcp_enter_memory_pressure,
- .sockets_allocated = &tcp_sockets_allocated,
+ .memory_pressure = memory_pressure_tcp,
+ .sockets_allocated = sockets_allocated_tcp,
    .orphan_count = &tcp_orphan_count,
- .memory_allocated = &tcp_memory_allocated,
- .memory_pressure = &tcp_memory_pressure,
- .sysctl_mem = sysctl_tcp_mem,
+ .mem_allocated_add = memory_allocated_tcp_add,
+ .prot_mem = tcp_sysctl_mem,
    .sysctl_wmem = sysctl_tcp_wmem,
    .sysctl_rmem = sysctl_tcp_rmem,
    .max_header = MAX_TCP_HEADER,
diff --git a/net/ipv4/tcp_output.c b/net/ipv4/tcp_output.c
index 882e0b0..06aeb31 100644
--- a/net/ipv4/tcp_output.c
+++ b/net/ipv4/tcp_output.c
@@ -1912,7 +1912,7 @@ u32 __tcp_select_window(struct sock *sk)
    if (free_space < (full_space >> 1)) {
        icsk->icsk_ack.quick = 0;

- if (tcp_memory_pressure)
+ if (sk_memory_pressure(sk))
        tp->rcv_ssthresh = min(tp->rcv_ssthresh,
            4U * tp->advmss);

diff --git a/net/ipv4/tcp_timer.c b/net/ipv4/tcp_timer.c
index ecd44b0..2c67617 100644
--- a/net/ipv4/tcp_timer.c
+++ b/net/ipv4/tcp_timer.c
@@ -261,7 +261,7 @@ static void tcp_delack_timer(unsigned long data)
    }

out:
- if (tcp_memory_pressure)
+ if (sk_memory_pressure(sk))
    sk_mem_reclaim(sk);
out_unlock:

```



```

    bh_unlock_sock(sk);
diff --git a/net/ipv4/udp.c b/net/ipv4/udp.c
index 1b5a193..21604b4 100644
--- a/net/ipv4/udp.c
+++ b/net/ipv4/udp.c
@@ -120,9 +120,6 @@ EXPORT_SYMBOL(sysctl_udp_rmem_min);
int sysctl_udp_wmem_min __read_mostly;
EXPORT_SYMBOL(sysctl_udp_wmem_min);

-atomic_long_t udp_memory_allocated;
-EXPORT_SYMBOL(udp_memory_allocated);
-
#define MAX_UDP_PORTS 65536
#define PORTS_PER_CHAIN (MAX_UDP_PORTS / UDP_HTABLE_SIZE_MIN)

@@ -1918,6 +1915,20 @@ unsigned int udp_poll(struct file *file, struct socket *sock, poll_table
*wait)
}
EXPORT_SYMBOL(udp_poll);

+static atomic_long_t udp_memory_allocated;
+long memory_allocated_udp_add(struct mem_cgroup *memcg, long val,
+    int *parent_status)
+{
+ return atomic_long_add_return(val, &udp_memory_allocated);
+}
+EXPORT_SYMBOL(memory_allocated_udp_add);
+
+long *udp_sysctl_mem(const struct mem_cgroup *memcg)
+{
+ return sysctl_udp_mem;
+}
+EXPORT_SYMBOL(udp_sysctl_mem);
+
struct proto udp_prot = {
    .name    = "UDP",
    .owner   = THIS_MODULE,
@@ -1936,8 +1947,8 @@ struct proto udp_prot = {
    .unhash  = udp_lib_unhash,
    .rehash  = udp_v4_rehash,
    .get_port = udp_v4_get_port,
- .memory_allocated = &udp_memory_allocated,
- .sysctl_mem    = sysctl_udp_mem,
+ .mem_allocated_add = &memory_allocated_udp_add,
+ .prot_mem    = udp_sysctl_mem,
    .sysctl_wmem  = &sysctl_udp_wmem_min,
    .sysctl_rmem  = &sysctl_udp_rmem_min,
    .obj_size     = sizeof(struct udp_sock),

```

```
diff --git a/net/ipv6/tcp_ipv6.c b/net/ipv6/tcp_ipv6.c
index 7b8fc57..bdc0003 100644
--- a/net/ipv6/tcp_ipv6.c
+++ b/net/ipv6/tcp_ipv6.c
@@ -1992,7 +1992,7 @@ static int tcp_v6_init_sock(struct sock *sk)
     sk->sk_rcvbuf = sysctl_tcp_rmem[1];
```

```

    local_bh_disable();
-   percpu_counter_inc(&tcp_sockets_allocated);
+   sk_sockets_allocated_inc(sk);
    local_bh_enable();

    return 0;
@@ -2201,11 +2201,11 @@ struct proto tcpv6_prot = {
    .unhash   = inet_unhash,
    .get_port = inet_csk_get_port,
    .enter_memory_pressure = tcp_enter_memory_pressure,
-   .sockets_allocated = &tcp_sockets_allocated,
-   .memory_allocated = &tcp_memory_allocated,
-   .memory_pressure = &tcp_memory_pressure,
+   .sockets_allocated = sockets_allocated_tcp,
+   .mem_allocated_add = memory_allocated_tcp_add,
+   .memory_pressure = memory_pressure_tcp,
    .orphan_count = &tcp_orphan_count,
-   .sysctl_mem = sysctl_tcp_mem,
+   .prot_mem = tcp_sysctl_mem,
    .sysctl_wmem = sysctl_tcp_wmem,
    .sysctl_rmem = sysctl_tcp_rmem,
    .max_header = MAX_TCP_HEADER,
```

```
diff --git a/net/ipv6/udp.c b/net/ipv6/udp.c
index bb95e8e..0be7cbc 100644
--- a/net/ipv6/udp.c
+++ b/net/ipv6/udp.c
@@ -1465,8 +1465,8 @@ struct proto udpv6_prot = {
    .unhash   = udp_lib_unhash,
    .rehash   = udp_v6_rehash,
    .get_port  = udp_v6_get_port,
-   .memory_allocated = &udp_memory_allocated,
-   .sysctl_mem   = sysctl_udp_mem,
```

```

+   .mem_allocated_add = memory_allocated_udp_add,
+   .prot_mem   = udp_sysctl_mem,
    .sysctl_wmem   = &sysctl_udp_wmem_min,
    .sysctl_rmem   = &sysctl_udp_rmem_min,
    .obj_size   = sizeof(struct udp6_sock),
```

```
diff --git a/net/sctp/socket.c b/net/sctp/socket.c
index 836aa63..8c0cde9 100644
--- a/net/sctp/socket.c
+++ b/net/sctp/socket.c
```

```

@@ -119,11 +119,32 @@ static int sctp_memory_pressure;
static atomic_long_t sctp_memory_allocated;
struct percpu_counter sctp_sockets_allocated;

+static long *sctp_sysctl_mem(const struct mem_cgroup *memcg)
+{
+ return sysctl_sctp_mem;
+}
+
static void sctp_enter_memory_pressure(struct sock *sk)
{
sctp_memory_pressure = 1;
}

+static int *memory_pressure_sctp(const struct mem_cgroup *memcg)
+{
+ return &sctp_memory_pressure;
+}
+
+static long memory_allocated_sctp_add(struct mem_cgroup *memcg, long val,
+int *parent_status)
+{
+ return atomic_long_add_return(val, &sctp_memory_allocated);
+}
+
+static struct
+percpu_counter *sockets_allocated_sctp(const struct mem_cgroup *memcg)
+{
+ return &sctp_sockets_allocated;
+}

/* Get the sndbuf space available at the time on the association. */
static inline int sctp_wspace(struct sctp_association *asoc)
@@ -6831,13 +6852,13 @@ struct proto sctp_prot = {
.unhash = sctp_unhash,
.get_port = sctp_get_port,
.obj_size = sizeof(struct sctp_sock),
- .sysctl_mem = sysctl_sctp_mem,
+ .prot_mem = sctp_sysctl_mem,
.sysctl_rmem = sysctl_sctp_rmem,
.sysctl_wmem = sysctl_sctp_wmem,
- .memory_pressure = &sctp_memory_pressure,
+ .memory_pressure = memory_pressure_sctp,
.enter_memory_pressure = sctp_enter_memory_pressure,
- .memory_allocated = &sctp_memory_allocated,
- .sockets_allocated = &sctp_sockets_allocated,
+ .mem_allocated_add = memory_allocated_sctp_add,
+ .sockets_allocated = sockets_allocated_sctp,

```

```

};

#ifdef CONFIG_IPV6 || defined(CONFIG_IPV6_MODULE)
@@ -6863,12 +6884,12 @@ struct proto sctp6_prot = {
    .unhash = sctp_unhash,
    .get_port = sctp_get_port,
    .obj_size = sizeof(struct sctp6_sock),
-   .sysctl_mem = sysctl_sctp_mem,
+   .prot_mem = sctp_sysctl_mem,
    .sysctl_rmem = sysctl_sctp_rmem,
    .sysctl_wmem = sysctl_sctp_wmem,
-   .memory_pressure = &sctp_memory_pressure,
+   .memory_pressure = memory_pressure_sctp,
    .enter_memory_pressure = sctp_enter_memory_pressure,
-   .memory_allocated = &sctp_memory_allocated,
-   .sockets_allocated = &sctp_sockets_allocated,
+   .mem_allocated_add = memory_allocated_sctp_add,
+   .sockets_allocated = sockets_allocated_sctp,
};
#endif /* defined(CONFIG_IPV6) || defined(CONFIG_IPV6_MODULE) */
--
1.7.6.4

```
