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Subject: [PATCH 3/12] L2 network namespace: loopback device virtualization  
Posted by [Mishin Dmitry](#) on Wed, 06 Dec 2006 22:25:45 GMT  
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Added per-namespace network loopback device

Signed-off-by: Dmitry Mishin <dim@openvz.org>

```
---
drivers/net/Space.c      |  5 +-
drivers/net/loopback.c   | 103 ++++++-----
include/linux/net_namespace.h |  2
include/linux/netdevice.h | 14 +++++
net/core/dev.c           |  3 -
net/core/net_namespace.c | 12 +++++
net/ipv4/devinet.c       |  2
net/ipv6/addrconf.c      |  2
net/ipv6/route.c         |  6 +-
9 files changed, 102 insertions(+), 47 deletions(-)
```

```
--- linux-2.6.19-rc6-mm2.orig/drivers/net/Space.c
```

```
+++ linux-2.6.19-rc6-mm2/drivers/net/Space.c
```

```
@ @ -33,6 +33,7 @ @
```

```
#include <linux/errno.h>
```

```
#include <linux/init.h>
```

```
#include <linux/netlink.h>
```

```
+#include <linux/net_namespace.h>
```

```
/* A unified ethernet device probe. This is the easiest way to have every
   ethernet adaptor have the name "eth[0123...]".
```

```
@ @ -353,14 +354,14 @ @ static void __init trif_probe2(int unit)
```

```
 * The loopback device is global so it can be directly referenced
```

```
 * by the network code. Also, it must be first on device list.
```

```
 */
```

```
-extern int loopback_init(void);
```

```
+extern int loopback_init(struct net_namespace *);
```

```
/* Statically configured drivers -- order matters here. */
```

```
static int __init net_olddevs_init(void)
```

```
{
    int num;
```

```
- if (loopback_init()) {
```

```
+ if (loopback_init(current_net_ns)) {
```

```
    printk(KERN_ERR "Network loopback device setup failed\n");
```

```
}
```

```
--- linux-2.6.19-rc6-mm2.orig/drivers/net/loopback.c
```

```

+++ linux-2.6.19-rc6-mm2/drivers/net/loopback.c
@@ -58,12 +58,6 @@
#include <linux/tcp.h>
#include <linux/percpu.h>

-struct pcpu_lstats {
- unsigned long packets;
- unsigned long bytes;
-};
-static DEFINE_PER_CPU(struct pcpu_lstats, pcpu_lstats);
-
#define LOOPBACK_OVERHEAD (128 + MAX_HEADER + 16 + 16)

/* KISS: just allocate small chunks and copy bits.
@@ -154,7 +148,7 @@ static int loopback_xmit(struct sk_buff
dev->last_rx = jiffies;

/* it's OK to use __get_cpu_var() because BHs are off */
- lb_stats = &__get_cpu_var(pcpu_lstats);
+ lb_stats = per_cpu_ptr(pcpu_lstats_ptr, smp_processor_id());
lb_stats->bytes += skb->len;
lb_stats->packets++;

@@ -163,11 +157,9 @@ static int loopback_xmit(struct sk_buff
return 0;
}

-static struct net_device_stats loopback_stats;
-
static struct net_device_stats *get_stats(struct net_device *dev)
{
- struct net_device_stats *stats = &loopback_stats;
+ struct net_device_stats *stats = netdev_priv(dev);
unsigned long bytes = 0;
unsigned long packets = 0;
int i;
@@ -175,7 +167,7 @@ static struct net_device_stats *get_stat
for_each_possible_cpu(i) {
const struct pcpu_lstats *lb_stats;

- lb_stats = &per_cpu(pcpu_lstats, i);
+ lb_stats = per_cpu_ptr(pcpu_lstats_ptr, i);
bytes += lb_stats->bytes;
packets += lb_stats->packets;
}
@@ -200,38 +192,73 @@ static const struct ethtool_ops loopback
.get_rx_csum = always_on,
};

```

```

-/*
- * The loopback device is special. There is only one instance and
- * it is statically allocated. Don't do this for other devices.
- */
-struct net_device loopback_dev = {
- .name = "lo",
- .get_stats = &get_stats,
- .priv = &loopback_stats,
- .mtu = (16 * 1024) + 20 + 20 + 12,
- .hard_start_xmit = loopback_xmit,
- .hard_header = eth_header,
- .hard_header_cache = eth_header_cache,
- .header_cache_update = eth_header_cache_update,
- .hard_header_len = ETH_HLEN, /* 14 */
- .addr_len = ETH_ALEN, /* 6 */
- .tx_queue_len = 0,
- .type = ARPHRD_LOOPBACK, /* 0x0001*/
- .rebuild_header = eth_rebuild_header,
- .flags = IFF_LOOPBACK,
- .features = NETIF_F_SG | NETIF_F_FRAGLIST
+struct net_device *loopback_dev_p;
+EXPORT_SYMBOL(loopback_dev_p);
+
+struct pcpu_lstats *pcpu_lstats_p;
+EXPORT_SYMBOL(pcpu_lstats_p);
+
+void loopback_dev_dtor(struct net_device *dev)
+{
+ free_percpu(dev->net_ns->pcpu_lstats_p);
+ free_netdev(dev);
+}
+
+void loopback_dev_ctor(struct net_device *dev)
+{
+ dev->mtu = (16 * 1024) + 20 + 20 + 12;
+ dev->hard_start_xmit = loopback_xmit;
+ dev->hard_header = eth_header;
+ dev->hard_header_cache = eth_header_cache;
+ dev->header_cache_update = eth_header_cache_update;
+ dev->hard_header_len = ETH_HLEN; /* 14 */
+ dev->addr_len = ETH_ALEN; /* 6 */
+ dev->tx_queue_len = 0;
+ dev->type = ARPHRD_LOOPBACK; /* 0x0001*/
+ dev->rebuild_header = eth_rebuild_header;
+ dev->flags = IFF_LOOPBACK;
+ dev->features = NETIF_F_SG | NETIF_F_FRAGLIST

```

```

#ifdef LOOPBACK_TSO
    | NETIF_F_TSO
#endif
    | NETIF_F_NO_CSUM | NETIF_F_HIGHDMA
-    | NETIF_F_LLTX,
- .ethtool_ops = &loopback_ethtool_ops,
-};
+    | NETIF_F_LLTX;
+ dev->ethtool_ops = &loopback_ethtool_ops;
+ dev->get_stats = &get_stats;
+ dev->destructor = loopback_dev_dtor;
+}

/* Setup and register the loopback device. */
-int __init loopback_init(void)
+int loopback_init(struct net_namespace *ns)
{
- return register_netdev(&loopback_dev);
-};
+ int err;
+
+ err = -ENOMEM;
+ ns->loopback_dev_p = alloc_netdev(sizeof(struct net_device_stats), "lo",
+     loopback_dev_ctor);
+ if (ns->loopback_dev_p == NULL)
+     goto out;
+ ns->pcpu_lstats_p = alloc_percpu(struct pcpu_lstats);
+ if (ns->pcpu_lstats_p == NULL)
+     goto out_stats;
+ /*
+  * loopback device doesn't hold active reference: it doesn't prevent
+  * stopping of net_namespace. So, just put old namespace.
+  */
+ put_net_ns(ns->loopback_dev_p->net_ns);
+ ns->loopback_dev_p->net_ns = ns;
+ err = register_netdev(ns->loopback_dev_p);
+ if (err)
+     goto out_register;
+ return 0;

-EXPORT_SYMBOL(loopback_dev);
+out_register:
+ free_percpu(ns->pcpu_lstats_p);
+ /* in order to avoid put in free_netdev() */
+ ns->loopback_dev_p->net_ns = NULL;
+out_stats:
+ free_netdev(ns->loopback_dev_p);
+out:

```

```

+ return err;
+}
--- linux-2.6.19-rc6-mm2.orig/include/linux/net_namespace.h
+++ linux-2.6.19-rc6-mm2/include/linux/net_namespace.h
@@ -9,6 +9,8 @@ struct net_namespace {
    struct kref kref;
    struct nsproxy *ns;
    struct net_device *dev_base_p, **dev_tail_p;
+ struct net_device *loopback_dev_p;
+ struct pcpu_lstats *pcpu_lstats_p;
    unsigned int hash;
};

--- linux-2.6.19-rc6-mm2.orig/include/linux/netdevice.h
+++ linux-2.6.19-rc6-mm2/include/linux/netdevice.h
@@ -562,16 +562,28 @@ struct packet_type {
#include <linux/notifier.h>
#include <linux/net_namespace.h>

-extern struct net_device loopback_dev; /* The loopback */
+struct pcpu_lstats {
+ unsigned long packets;
+ unsigned long bytes;
+};
+
+extern struct net_device *loopback_dev_p;
+extern struct pcpu_lstats *pcpu_lstats_p;
#ifdef CONFIG_NET_NS
#define loopback_dev_ptr loopback_dev_p
#define pcpu_lstats_ptr pcpu_lstats_p
extern struct net_device *dev_base; /* All devices */
#define dev_base_ns(dev) dev_base
#else
#define loopback_dev_ptr (current_net_ns->loopback_dev_p)
#define pcpu_lstats_ptr (current_net_ns->pcpu_lstats_p)
#define dev_base (current_net_ns->dev_base_p)
#define dev_base_ns(dev) (dev->net_ns->dev_base_p)
#endif
#define loopback_dev (*loopback_dev_ptr) /* The loopback */
extern rwlock_t dev_base_lock; /* Device list lock */

+extern int loopback_init(struct net_namespace *);
extern int netdev_boot_setup_check(struct net_device *dev);
extern unsigned long netdev_boot_base(const char *prefix, int unit);
extern struct net_device *dev_getbyhwaddr(unsigned short type, char *hwaddr);
--- linux-2.6.19-rc6-mm2.orig/net/core/dev.c
+++ linux-2.6.19-rc6-mm2/net/core/dev.c
@@ -3254,7 +3254,8 @@ void free_netdev(struct net_device *dev)

```

```

    ns = dev->net_ns;
    if (ns != NULL) {
-   put_net_ns(ns);
+   if (dev != ns->loopback_dev_p)
+   put_net_ns(ns);
        dev->net_ns = NULL;
    }
#endif
--- linux-2.6.19-rc6-mm2.orig/net/core/net_namespace.c
+++ linux-2.6.19-rc6-mm2/net/core/net_namespace.c
@@ -10,6 +10,7 @@
#include <linux/nsproxy.h>
#include <linux/net_namespace.h>
#include <linux/net.h>
+#include <linux/netdevice.h>

struct net_namespace init_net_ns = {
    .kref = {
@@ -18,6 +19,8 @@ struct net_namespace init_net_ns = {
    .ns = &init_nsproxy,
    .dev_base_p = NULL,
    .dev_tail_p = &init_net_ns.dev_base_p,
+ .loopback_dev_p = NULL,
+ .pcpu_lstats_p = NULL,
    };

#ifdef CONFIG_NET_NS
@@ -40,7 +43,15 @@ static struct net_namespace *clone_net_n
    ns->dev_base_p = NULL;
    ns->dev_tail_p = &ns->dev_base_p;
    ns->hash = net_random();
+
+ if (loopback_init(ns))
+ goto out_loopback;
    return ns;
+
+out_loopback:
+ BUG_ON(atomic_read(&ns->kref.refcount) != 1);
+ kfree(ns);
+ return NULL;
    }

/*
@@ -78,6 +89,7 @@ void free_net_ns(struct kref *kref)
    struct net_namespace *ns;

    ns = container_of(kref, struct net_namespace, kref);

```

```

+ unregister_netdev(ns->loopback_dev_p);
  if (ns->dev_base_p != NULL) {
    printk("NET_NS: BUG: namespace %p has devices! ref %d\n",
      ns, atomic_read(&ns->kref.refcount));
--- linux-2.6.19-rc6-mm2.orig/net/ipv4/devinet.c
+++ linux-2.6.19-rc6-mm2/net/ipv4/devinet.c
@@ -197,7 +197,7 @@ static void inetdev_destroy(struct in_de
  ASSERT_RTNL();

  dev = in_dev->dev;
- if (dev == &loopback_dev)
+ if (dev == loopback_dev_p)
  return;

  in_dev->dead = 1;
--- linux-2.6.19-rc6-mm2.orig/net/ipv6/addrconf.c
+++ linux-2.6.19-rc6-mm2/net/ipv6/addrconf.c
@@ -2361,7 +2361,7 @@ static int addrconf_ifdown(struct net_de

  ASSERT_RTNL();

- if (dev == &loopback_dev && how == 1)
+ if (dev == loopback_dev_p && how == 1)
  how = 0;

  rt6_ifdown(dev);
--- linux-2.6.19-rc6-mm2.orig/net/ipv6/route.c
+++ linux-2.6.19-rc6-mm2/net/ipv6/route.c
@@ -124,7 +124,6 @@ struct rt6_info ip6_null_entry = {
  .dst = {
    .__refcnt = ATOMIC_INIT(1),
    .__use = 1,
-   .dev = &loopback_dev,
    .obsolete = -1,
    .error = -ENETUNREACH,
    .metrics = { [RTAX_HOPLIMIT - 1] = 255, },
@@ -150,7 +149,6 @@ struct rt6_info ip6_prohibit_entry = {
  .dst = {
    .__refcnt = ATOMIC_INIT(1),
    .__use = 1,
-   .dev = &loopback_dev,
    .obsolete = -1,
    .error = -EACCES,
    .metrics = { [RTAX_HOPLIMIT - 1] = 255, },
@@ -170,7 +168,6 @@ struct rt6_info ip6_blk_hole_entry = {
  .dst = {
    .__refcnt = ATOMIC_INIT(1),
    .__use = 1,

```

```

- .dev = &loopback_dev,
  .obsolete = -1,
  .error = -EINVAL,
  .metrics = { [RTAX_HOPLIMIT - 1] = 255, },
@@ -2469,7 +2466,10 @@ void __init ip6_route_init(void)
#endif
#ifdef CONFIG_IPV6_MULTIPLE_TABLES
  fib6_rules_init();
+ ip6_prohibit_entry.u.dst.dev = &loopback_dev;
+ ip6_blk_hole_entry.u.dst.dev = &loopback_dev;
#endif
+ ip6_null_entry.u.dst.dev = &loopback_dev;
}

void ip6_route_cleanup(void)

```

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