IPv6 Development Status 2005

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Agenda

• Recent Activities
  – IPv6 Ready Logo Phase-1 / Phase-2
  – TAHI Automatic Test Running System
  – Statistics
  – Advanced API (RFC3542)
  – IPsec
  – Mobile IPv6
  – Connection Tracking

• Misc. TODOs / Future Plans
IPv6 Ready Logo

- We are finally "IPv6 Ready!"
  - 2.6.11-rc2 is IPv6 Ready Logo Phase-1 certified
    - with special version of radvd (Router Advertisement Daemon)
  - 2.6.12 is available with improvements to pass the Self Test for IPv6 Ready Logo Phase-2, Core Protocols.
    - with special version of radvd
    - interop is not tested yet...
- http://www.ipv6ready.org
TAHI Automatic Test Running System
(aka USAGI Testlab)

Chinen Mitsuru @IBM Japan, Ltd.
Hideaki Yoshifuji @Keio University
USAGI Testlab

- Test every new snapshots automatically
- Target
  - IPv6 Ready Logo Phase-1
    - Host
    - Router
  - IPv6 Ready Logo Phase-2, Core Protocols
    - Host
    - Router
USAGI Testlab TODOs

- Increase test targets
  - IPv6 Ready Logo Phase-2
    - IPsec
    - Mobile IPv6
  - The Original TAHI Cts?
  - Even now, it takes so loooooooooooooooong time...

- Description / Documentation
  - kernel? userspace?

- Requests?
Statistics

Koichi Kunitake @Anchor Technology, Inc.
Hideaki Yoshifuji @Keio University
Statistics

- Try not to get refcnt everytime by using rt6i_idev in rt6_info{} (rt6).

- Issue
  - dst (rt6) is unavailable in ipv6_rcv().
  - Is it safe to use __in6_dev_get() in ipv6_rcv()?
    - Yes: okay, do it.
    - No: Hmm...
      1) in6_dev_get()?
      2) put critical stats in net_device()?! 
       - IPSTATS_MIB_INRECEIVES
Statistics TODO / Future Plans

• clean-ups and check races
  – will be submitted after this

• The “HC" Counters
  – plan to implement in not-too-generic manner
Advanced API

Hideaki YOSHIFUJI @Keio University
Advanced API (RFC3542) (1)

• Basic
  - Rename access to extension headers
    • IPV6_RECVHOPOPTS, IPV6_RECVDSTOPTS, ...
    • OLD: IPV6_HOPOPTS, IPV6_DSTOPTS, ...
  - Split the "sticky" option
    • IPV6_HOPOPTS, IPV6_DSTOPTS, ...
    • OLD: IPV6_PKTOPTIONS
Advanced API (2)

• Additional
  – PMTU discovery
    • IPV6_USE_MIN_MTU (like IPV6_MTU)
      – disable for multicast (default) / always / disable
  – Fragmentation
    • IPV6_DONTFRAG
  – PMTU notification / query
    • IPV6_RECVPMTU, IPV6_PMTU
    • sockets w/ IPV6_RECVPMTU receives PMTU information for all destinations
    • check current PMTU by IPV6_PMTU (connected socket)
Advanced API

• Collaborating with David L. Stevens @IBM
• Implemented (most of) basic part
  – Preserving old API by renaming old ones.
    • IPV6_2292xxx
  – Reallocates ipv6_txoptions{}
  – Not tested yet; will do, of course.
Advanced API Issues (1)

- We assume the order of extension headers
  - we record the offset to each extension header in skb->cb in extension header handlers, assuming the standard order.
  - we need to preserve the order.

- Solution?
  - remember last offset to the pointer and parse the packet again
Advanced API Issues (2)

- Is it Okay to access skb->nh.raw + offset in recvmsg()? No!
  - need to implement put_cmsg_skb() to cope with cmsg, userspace pointers, and non-linear skb
  - will do.
IPsec

IPsec Team
Mitsuru Kanda @Toshiba Corp. (emertus)
Kazunori Miyazawa @Yokogawa Electric Corp.
IPsec Status (1)

• Score of IPv6 Ready Logo Phase-2 IPsec Self Test (host, aka endnode) is not so bad.
  – AES-128-XCBC-96 is missing

• router, aka sgw, will be tested
IPsec Status (2): RFC3566

- RFC3566 AES-128-XCBC-96
  - Keyed-MAC algorithm
  - Required for IPv6 Ready Logo Phase-2 IPsec
  - We implemented it like hmac extension against md5 and/or sha1.
  - It works; tested with test vectors in the RFC by using tcrypt.
  - Will be submitted shortly
IPsec Status (3): racoon2

- WIDE/IPsec working group released racoon2 IKEv2 and KINK.
  - racoon2 runs on both Linux and NetBSD.
  - design and implementation of racoon2 is different from ones of racoon.
  - They will implement IKEv1 on racoon2 architecture.
- Maintenance of racoon1 has been tossed to sourceforge.
  - KAME is trying to pass over things to community.
IPsec Question (1): Asymmetry

XFRM Policy Asymmetry

• FAQ

• We think the interface is confusing.

• We would like to know the reason of asymmetry.
  – Why is there fwd or isn't fwd-out for outbound?

• We / people prefer a symmetric interface.
IPsec Question (2): Interprotocol tunnel

- We are interested in IPv6 over IPv4 IPsec tunnel.
- Status?
Mobile IPv6

MIP6 Team “U-MIP”

Noriaki Takamiya @NTT Software Corporation
Masafumi Aramoto @Sharp Corporation
Masahide Nakamura @Hitachi Communication Technologies, Ltd.
Shinta Sugimoto @Nippon Ericsson K.K.
MIPL2: Mobile IPv6 for Linux

- What is MIPL2?
- Interaction between MIPv6 and IPsec/IKE
- Kernel design
- Development status
- Future plan
What is MIPL2?

• A Mobile IPv6 (MIPv6) stack targets 2.6 kernel
  – support MIPv6 basic specification RFC377{5,6}
  – support IPsec/IKE interaction

• USAGI/WIDE Project is making joint effort with Helsinki University of Technology (HUT) for MIPL2
  – UMIP Team
    • Noriaki Takamiya @NTT Software Corporation
    • Masafumi Aramoto @Sharp Corporation
    • Masahide Nakamura @Hitachi Communication Technologies, Ltd.
    • Shinta Sugimoto @Nippon Ericsson K.K.
Mobile IPv6 Kernel Design

- New daemon is defined and it controls kernel status
- The daemon handles
  - signaling
  - master information (e.g. binding cache)
  - movement detection
  - IPsec interaction
- not so large lines required for kernel
Mobile IPv6 & IPsec/IKE Interaction

- IPsec tunnel established between the MN and HA needs to be updated whenever the MN changes its CoA.

- IPsec/IKE should also be aware of ‘movement’ of MN because:
  - IPsec Security Policy Database (SPD) needs to be updated in accordance with CoA change.
  - IPsec Security Association (SADB) needs to be updated in accordance with CoA change.
  - IKE needs to update the IKE connection (K-bit).

- A solution:
  - Make an interface between Mobile IPv6 and IPsec/IKE by extending PF_KEY framework (PF_KEY MIGRATE message).
  - “PF_KEY Extension as an Interface between Mobile IPv6 and IPsec/IKE”, draft-sugimoto-mip6-pfkey-migrate-00.
  - Implemented in MIPL2.0 RC2.
MIPL2 Kernel Functional Block

user-land

kernel

ioctl

socket(raw)

netlink

key

icmp

mobility header

inet6

MIP6 state

IPsec SA

MIP6 policy

IPsec SP

migrate

neighbor discovery

policy routing

device

proxy

inet6

home address

policy routing

routing

address

xfrm

Existing in 2.6 mainline

New for 2.6 mainline
MIPL2: XFRM Modifications (1/3)

- extend “xfrm template” and “xfrm state” to support two more protocols/extension headers (i.e. xfrm is a subsets of binding cache/binding update list in kernel)
  - Destination options header (to carry home address option)
  - Routing header type 2

- Issue
  - It must be prepared one policy which carries both MIPv6 template and IPsec template in advance by user-space when using IPsec and MIPv6 at the same time; MIPL2 daemon must handle IPsec policy to append MIPv6 protocol to it
    - plan: separating policy in kernel and combined them (testing experimental code)
MIPL2: XFRM Modifications (2/3)

• Add xfrm notification (from kernel to the daemon)
  – for Binding Error; It is occurred when packet is dropped by xfrm policy (MIPv6 policy)
Mobile IPv6

IKE daemon

XFRM

SPD

SADB

Userland

Kernel

Mobile IPv6 (mip6d)

MN’s endpoint address is changed from \textit{addr1} to \textit{addr2}!

IPsec/IKE

IKE daemon (racoon)

PF_KEY Socket

MIPL2: XFRM Modifications(3/3)

- Use "Migrate interface” to update endpoint address of IPsec tunnel when MN moves
MIPL2: Address and Routing

- Identifying the Home Address
  - add IFA_F_HOMEADDRESS to ifa_flags

- Policy Routing based on source address
  - each source address has each FIB entry based on IPv4 multiple table
  - policy per Home Address for route/interface selection can be used for multiple Home Address support
MIPL2 Status

• Released “RC2” in May 2005
  – based on 2.6.8.1

• Now working on 2.6.11

• Solid and stable performance proved by the successful results of TAHI conformance tests for MN/HA/CN
  – targeting getting full scores

• Release 2.0
  – End of July
MIP6: Future Plans (1)

- Extensions
  - HAHA
    - inter HA protocol for improving reliability
  - Multiple CoA
    - optimized route path selection in multihomed environment
  - Policy Handoff
    - modularized movement detection
MIP6: Future Plans (2)

- HMIP
  - reduction of signaling overhead
  - location privacy
- MIPv6 in different address space
  - IPv4 traversal
  - IPv4 homeaddress support
- NEMO (Nautilus6 Project)
- FMIP (RFC4068; Nautilus6 Project)
  - Fast handover
Connection Tracking

Yasuyuki Kozakai @Toshiba Corp.
Nf_conntrack

- IP-independent connection tracking
  - supersedes ip_conntrack (and ip6_conntrack)
- Collaborating Netfilter Project
  - already available there
- Status?
  - git trees?
Misc. TODO / Plans (1)

- Policy Routing
  - Based on work by MIPL2
- ISATAP
  - Based on patch from Fred Templin (author of the draft)
  - Need to refresh
- IPv4-over-IPv6 Tunnel
Misc. TODOs / Plans (2)

- Multicast Forwarding
  - Yuji Sekiya @Univ. Tokyo and myself
  - based on patch from Mickael Hoerdt @Universite' Louis Pasteur, Strasbourg

- Whatever things make us happy
Misc.

• We will get 10Gb connectivity in our office soon!
• Distributed computing
• XCAST (Explicit Multi-unicast
  – <http://www.xcast.jp> 
• Netnice
  – <http://www.netnice.org>
Conclusion

• Linux is IPv6 Ready!
  – It is the beginning.

• Things we're working on
  – Statistics
  – Advanced API (RFC3542)
  – IPsec
  – Mobile IPv6
  – Connection Tracking
Thank you