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Ipsec-tools: past, present and future

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Overview

- Man ipsec-tools
- Past
- Present
- Future

Ipsec-tools ???

IPsec in one single slide...

- IETF normalized security protocol
  - RFC2401 – 240x (“IKEv1”)
  - RFC4301 – 430x (“IKEv2”)
  - Lots of other RFCs and [expired] drafts....
- Security for IP
  - Peer's authentication
  - Confidentiality
  - Integrity
- At IP layer
  - “end to end”: Transport mode
  - “net to net”: Tunnel mode between gateways
    - Used to connect RFC1918 networks over internet

NETASQ

Okay, IPsec in two slides...

- Designed for gates with multiple tunnels
- Internet Key Exchange: dynamic negociation
  - Authenticates peer (X509 or preshared secrets)
  - Generates session keys with lifetime
- Kernel/Userland Interface
  PFKeyV2 (RFC 2367)
  - Socket interface
  - Various more or less standardized extensions
- Mandatory for IPv6

Ipsec-tools (very quick) overview

- Userland tools for IPSec
  - Library for PKFey interface
    - Messages between userland and kernel
  - IKE daemon (negociates keys[,...] with peers)
  - Command line tool to manipulate IPSec stack
- Runs on various OS
  - [Free|Net]BSD, MacOSX
  - Linux 2.6+
  - ????

Your attention please:
IPsec and security issues...

IPsec and security...

- IPsec protects traffic on the way.
  NO GUARANTEE about “what is the traffic”
- IKE's aggressive mode is weak, don't use it !
- PresharedKey's authentication is secure if your shared secred is a secret...
- Implementations may have some bugs
- DES is obsolete
- ESP is vulnerable to bit flipping
  - Use authentication for ESP !

Past....

A long time ago, in a far far galaxy...

- 1983: 4.2 BSD includes a TCP/IP stack :-)
- 1995/12: RFC 1883 for IPv6
- 1998: Launch of the KAME project
  - Main goal: provide an IPv6 stack for BSDs
- 1999: racoon in KAME's CVS

KAME's racoon issues

- Important features missing
  - Functionnal Roadwarrior mode
  - NAT-T
  - ModeCFG / XAuth / Hybrid
- Performance issues
- Security issues
- Quite no more reaction from the team

IPsec-tools's history

- 2003/02/26: Initial CVS revision
  – Goal: temporary fork to add Linux support
- 2004/09/13: Compiles again on NetBSD
- 2005/04/21: KAME drops racoon's support
  – Ipsec-tools is the “official” racoon for everyone
- 2006/09/15: Moved to NetBSD's CVS
  – Technical issues with Sourceforge
  – Some facilities: nightly builds, Coverity, ...
  – But still no SVN ;-)
- 2008/10/19 : New homepage, bugtracker, etc...

Present

NETASQ

For the public...

- pkg_install ipsec-tools
  (apt-get install ipsec-tools if needed....)
- Sources hosted at cvs.netbsd.org
  - cvs -d anoncvs.netbsd.org co ipsec-tools
- New homepage/tracker: http://trac.ipsec-tools.net
  - Bugtracker
  - Wiki (with doc soon ?)
  - Old page at Sourceforge.net still up but obsolete
- Mailing lists still at lists.sourceforge.net
  - ipsec-tools-core@lists.sourceforge.net also quite obsolete

The actual team

- Some “core developers” !
  - manu@NetBSD.org (NetBSD)
  - vanhu@FreeBSD.org (FreeBSD)
  - mgrooms@shrew.net (FreeBSD, tests on *)
  - timo.teras@iki.fi (Linux 2.6)
- “More or less members”
  - guillaume@free-4ever.net (admin)
  - julien.vanherzeele@netasq.com (NETASQ qualif)
- Many contributors on ipsec-tools-devel
  - Not only developers !
- People are welcome !

Great List of Cool Features

- NAT-Traversal (RFCs 3947 / 3948)
  - Native support for Linux 2.6+ / NetBSD
  - Patch report in progress for FreeBSD
  - Multiple peers behind the same IP ([Net|Free]BSD)
  - PFKey extension not clean
  - NAT-OA support in progress
- Dead Peer Detection (RFC 3706)
- ModeConfig / XAuth / Hybrid (expired drafts)
- Configuration Reload
- Privilege Separation
- Clean roadwarrior support

Not “features” but also cool...

- Lots of bugs fixed through years :-)
  - Some were security issues
- Improved performances
  - Scheduler (HEAD)
  - “fastquit” (still disabled by default)
  - Logging mechanism
- Some code cleanups
- “Obey” checkmode no more in sample confs
- ~~Autotools mechanism~~
  - Hey, we're talking about **cool** things !!!

~~svn~~ cvs diff -up -r past:present

How to use Configuration Reload...

- First, edit your racoon.conf :-)
- For dynamic peers (generate_policy):
  - Just kill -HUP <racoon's PID>
- For peers with static SPD
  - REQIDs have to be the same
  - PH1IDs have to be the same
  - ➔ Do NOT use spdflush !
  - ➔ Use spddelete to remove obsolete entries, then spdadd to add new ones

Dealing with roadwarriors: past

- On the “client side”, we just don't care...
- A long long time ago:
  It was just not possible on server side
- Some years ago: ModeConfig + ph1_[up|down].sh
- “generate_policy on” works since a few years
- Need to create “anonymous” sainfo entries
  – No control at all about traffic endpoints

Corresponding racoon.conf

```
Remote anonymous{
    ....
    generate_policy on;
    ....
}

sainfo anonymous {
    ....
}
```

Various issues…

- SPD entries generated from traffic endpoints
  - Provided by peer, and just accepted
  - Peer can force local traffic to go through his tunnel
  - Peer can generate dummy SPD entries to generate a local DOS
- No link between remote and sainfo section
  - Any "gateway" peer may match anonymous sainfo
  - A roadwarrior may also match another sainfo !

Dealing with roadwarriors now

- generate_policy [on|unique];
  - Unique needed to establish more than one phase2 with the same peer
- Ph1id
  - A strong link between a “remote” and a “sainfo” section
- “semi anonymous” sainfos (0.7)
  - You still can't predict peer's IP
  - You know what is your local network !

Corresponding racoon.conf (V 0.7)

```
Remote anonymous{
    ....
    generate_policy unique;
    ph1id 42;
    ....
}

sainfo 192.168.0.0/24 any anonymous {
    # 192.168.0.0/24 is Gate's network
    ph1id 42;
    ....
}
```

Dealing with roadwarriors soon (HEAD)

- generate_policy [on|unique];
- Ph1id
- “clientaddr” sainfos (HEAD)
  - Mode Config: address given by Mode Config
    - Already in HEAD
  - No Mode Config:
    - Peer's IP (tunnel endpoint)
    - If NAT-T, can also be an IP which match one of peer's hashes
    - Not yet implemented
    - What about “virtual adapters” on client side ?

Corresponding racoon.conf (V 0.8)

```
Remote anonymous{
    ....
    generate_policy unique;
    ph1id 42;
    ....
}

sainfo 192.168.0.0/24 any clientaddr {
    # 192.168.0.0/24 is Gate's network
    ph1id 42;
    ....
}
```

A few words about DPD

- DPD just checks IsakmpSA with peer
  - IsakmpSA can be ok but IPsec SAs are broken
  - IsakmpSA can be broken but IPsec SAs are ok
- DPD just flushes everything related to peer
  - Kernel/Peer will ask for new negociations “later”
- A bad DPD configuration can be worst than no DPD !

A few words about XAuth

- Please remember that XAuth's security relies on Phase1 security
  - No “group password”
  - No aggressive mode
- Hybrid authentication is your friend
  - Gate's authentication in phase1 with an X509 certificate
  - “Client” will authenticate with Xauth
  - Don't worry, nothing will be allowed after phase1 except XAuth

Future

NAT-T evolutions: PFKey cleanup

- Userland: in progress
- FreeBSD: in progress (in perforce)
- NetBSD: will need to be synced from FreeBSD
- Linux 2.6+
  - may already be ok,
  - won't get worst !
- What about old FreeBSD/NetBSD kernels ?
  - Support for “legacy_natt_pfkey” ?
  - How to detect it ?

NAT-T evolutions: Drafts and RFC...

- Supported versions selection actually done at configure time
  - Some need for a peer by peer setup ?
- RFC widely supported now
- Drafts 00/01 don't jump to UDP 4500, and some ugly configured firewalls only accept UDP 500...
- Remove support for drafts 05+ ?

IPSec and lot of SPD/SA entries (1)

- “Lot of” means something like 1 000++
  - Some of our customers want that (and more)
  - Looks like more people are asking it now !
- IPSec-tools problems: fast negociations....
  - Will need some optimizations
  - Threaded racoon ? It may be faster to rewrite it !
  - Actually, it can work.... with long lifetimes !
  - Of course, good hardware required !

IPSec and lot of SPD/SA entries (2)

- Main problem: Pfkey interface
  - One PFKey request to dump SPD/SAD
  - One message by answer
  - The buffer of PFKey's socket will fill quickly
- Solutions ?
  - Socket_buff_size++ (seems to works on Linux)
  - Kernel thread dedicated to PFKey (userland will have a chance to read while kernel writes)
  - Specific extension “[SPD]DUMP_FROM_X”
    - Kernel must know how to answer “buffer full”
    - Non aware userland tools will just fail.... as now
    - SPD/SAD changes at the same time will be announced by other PFKey messages

IPSec and lot of SPD/SA entries (3)

- Performance issues with huge SPD/SADB
  - Huge list, we have to find one entry...
- Solutions for SAs
  - Put used SAs at the beginning of the list
  - Use an SA cache ?
- Solutions for SPD ?
  - Common solutions for routing tables won't work
  - Order **is** important
  - FreeBSD6/FAST_IPSEC: spdcache (see graph)
  - We'll have to do “something”

SPDcache (soon in perforce.freebsd.org)

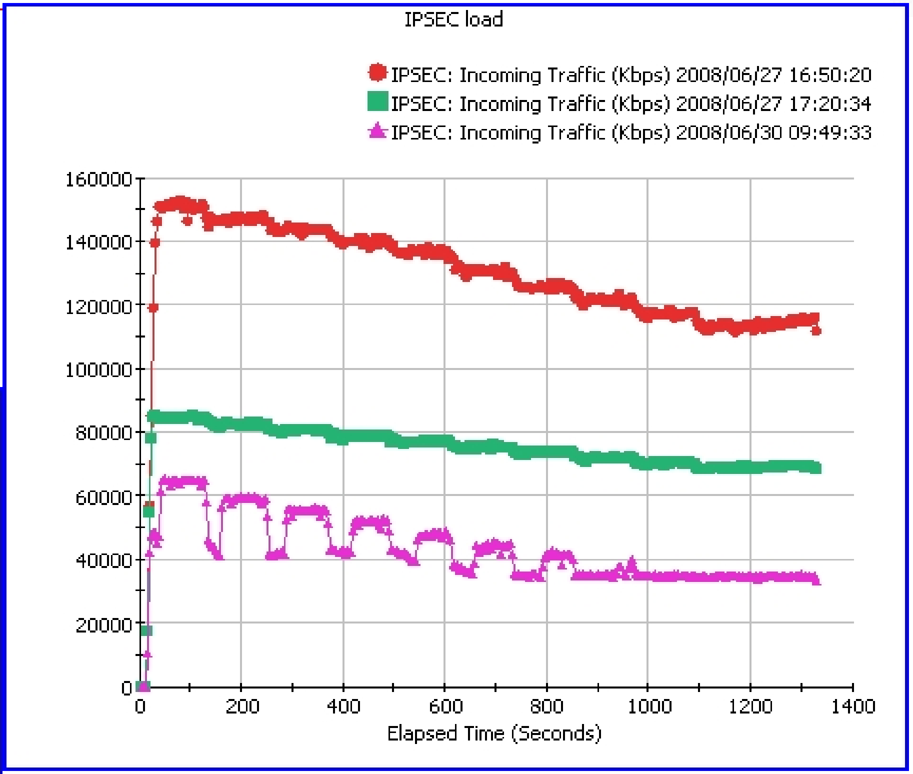
- Basic idea: remind recent SPD evaluations
  - Hash table, key computed from packet profile
  - One cache per entry: just kicks out previous cached value when hash collisions
  - The whole cache is invalidated each time the SPD changes
  - 2 specific results: “no cache” and “cache says No IPsec”
- No need to garbage
- Updates are done only when accessing the cache

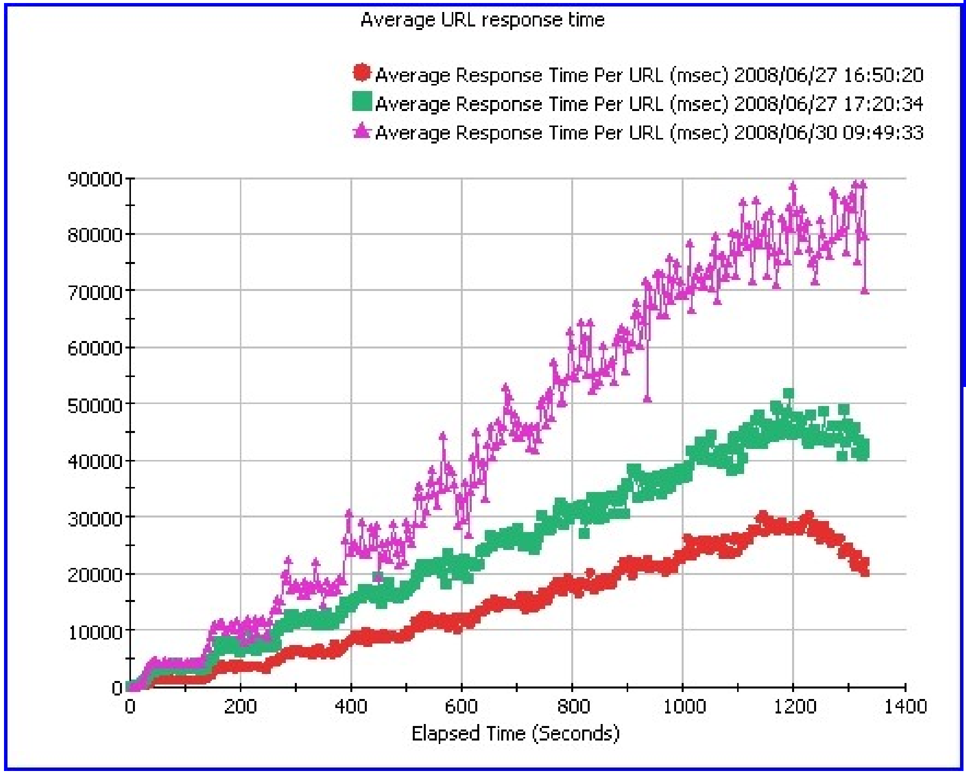
SPDcache benchs: setup

- 1000 Tunnels => 2000 SPD entries
- From 0 to ~ 400 used (randomly choosen)
- Try to generate highest throughput
- Not the best case for SPDcache
- Benchmarked:
  - FreeBSD4
  - FreeBSD6 (FastIPsec)
  - FreeBSD6 (FastIPsec) + SPDCache

SPDcache benchs: results

- FreeBSD6 + SPDCache
- FreeBSD6
- FreeBSD4





Missing features...

- High Availability
- Backup tunnel
- Multithreaded
- IKEv2 ?
- Automated non-regression test suite
  - Project may start soon...

Up to date slides at
http://people.freebsd.org/~vanhu
http://www.netbsd.org/~vanhu

Questions ?