Kea – DHCP servers in BIND10

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Agenda

1. About presenter and ISC

2. DHCP in BIND10 (codename Kea)
   • Reasons
   • Status

3. Performance

4. Kea Roadmap and plans
Who is Tomek?

- M.Sc., Ph.D from Gdansk University of Technology
- Primary author of Dibbler
  - Portable DHCPv6 implementation (srv, cli, relay)
  - Supports Win 2k-Win8, Linux, BSD, Solaris
  - Confirmed use in 34 countries
- 7 years at Intel (Network Quality Labs, chipsets group)
- 2 years at ISC
  - Lead Developer of BIND10 DHCP (Kea)
  - Occasional contributor to ISC-DHCP
- Active IETF participant since 2009
  - DHC WG co-chair
  - 2 RFCs, 15+ drafts
What is ISC?

Internet Systems Consortium, Inc. (ISC) is a non-profit 501(c)(3) public benefit corporation dedicated to supporting the infrastructure of the universal connected self-organizing Internet - and the autonomy of its participants - by developing and maintaining core production quality software, protocols, and operations.
BIND10 DHCP

Kea
Why DHCP rewrite?

- Existing code is 17 years old
- Hardware changed (many cores)
- Networks changed
- DHCP landscape changed
- New software development techniques
- Lacking performance
- Monolithic
- Documentation is lacking
- Complex code, difficult to extend
BIND10 DHCP
Codename Kea

- Common infrastructure with BIND10 DNS
  - On-line configuration
  - Logging
  - Statistics
- Performance is essential
- IPv6 is a first class citizen, not add-on
- C++ as a language of choice
- Multi-core support
- Switchable backends (mem+file, SQLite, MySQL, ...)
- Hooks
- Modular
- Resiliency (fault isolation and recovery)
Kea: Current status (1)

**DHCPv4 server**
(b10-dhcp4)
- Supports DORA
- Direct/Relayed traffic

**DHCPv6 server**
(b10-dhcp6)
- Supports SARR
- Direct/Relayed traffic

- Address assignment, renewal, release, expiration
- On-line configuration (common for all BIND10)
- Switchable backends: MySQL, memfile
- Custom option definitions
  - Standard options
  - Custom formats
  - Nested options
  - Option namespaces
Kea: Current status (2)

**DHCPv4 server**
(b10-dhcp4)

**DHCPv6 server**
(b10-dhcp6)

**Perfdhcp**
Performance Tool
(stand alone)

**libdhcpp++**
- general purpose DHCP library
- v4/v6 packet parsing/assembly
- v4/v6 options parsing/assembly
- interface detection (Linux, other OSes planned)
- socket management
Kea: Work to Date (2)

- Documentation
  - BIND10 Guide
  - BIND10 Developer's Guide
  - Man pages
- Designs
  - Hooks
  - Lease/database design
  - Option Definition Design

http://bind10.isc.org/docs/bind10-guide.html
http://bind10.isc.org/wiki/Kea
DHCP Performance
DHCP Performance
Problem Space

Vendors often provide performance results, why measure it again?

– Marketing data is always trustworthy, right?
– Your HW may differ from reference HW (CPU, disk, fs, OS,...)
– Your traffic model may differ

Conclusion:
The most reliable measurements are your own.
DHCP Performance Measurements (1)

- SOLICIT (DISCOVER)
- ADVERTISE (OFFER)
- REQUEST (REQUEST)
- REPLY (ACK)
- RENEW (REQUEST)
- REPLY (ACK)
DHCP Performance Measurements (2)
Perfdhcp :: Overview

• No feasible alternatives
  • are outdated (e.g. v4 only)
  • commercial (dedicated test HW is $$$$$)

• Need a tool that is:
  • Flexible (lots of options and knobs)
  • Portable (Linux, BSD, perhaps Solaris)
  • Test any conformant implementation
  • Free (open source)

• Started project on our own
Open source (ISC), currently Linux, but BSD and Solaris planned
DHCPv4 & DHCPv6 (2-way & 4-way exchanges)
Support for packet template files (optional)
Server/interface selection (multicast/unicast)
Parameterized traffic/test
- # of clients,
- # of transactions/sec,
- best effort test,
- test duration,
- number of requests,
- max number/% of drops ...
Diagnostics selector
Measurements

Perfdhcp :: Status
Rate: 986.6 exchanges/second, expected rate:

***Statistics for: SOLICIT-ADVERTISE***
sent packets: 9866
received packets: 9866
drops: 0
orphans: 0
min delay: 0.168 ms
avg delay: 0.263 ms
max delay: 0.655 ms
std deviation: 0.039 ms

perfdhcp
[-n<num-request>] [-p<test-period>] [-d<drop-time>] [-D<max-drop>]
[-l<local-addr|interface>] [-P<preload>] [-a<aggressivity>]
[-T<template-file>] [-X<xid-offset>] [-O<random-offset>]
[-E<time-offset>] [-S<srvid-offset>] [-I<ip-offset>]
[-x<diagnostic-selector>] [-w<wrapped>] [server]
Perfdhcp :: Roadmap

2013: No specific plans (unfunded)
- Implement support for Prefix Delegation
- Relays
  - Traffic via relays
  - Relay options (subscriber-id, remote-id,...)
  - DOCSIS3.0 options
- Expand customization
- Improve response validation

Long term: maintain and develop
Kea :: Performance Results(1)

- DHCP server run on a beefy hardware
  - HP ProLiant DL360 G7
  - Intel(R) Xeon(R) CPU E5649 (24 logical CPUs)
  - 72GB ram
  - HP Smart Array P410i + 10k rpm disks
- Client traffic generated by perfdhcp
- Performance may go...
  - ...up (optimizations, multi-core)
  - ...down (new features)
Kea :: Performance Results (2)

DHCP server performance

Stopped testing here. CPU ~ 60%
No disk operations (mem only)

* initial data. Your mileage may vary.
Kea Plans
2013 Kea Roadmap

• Support for directly-connected IPv4 clients
• Support for IPv6 relays
• DDNS daemon
• Hooks
• Separate DNS/DHCP build in BIND10
• Optional: Extend OS support to BSD, Solaris (?)
DHCP Hooks (1)

BIND 10 Process Model - DHCP (Kea)

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DHCP Hooks (2)

• Set of hooks to be included in the code:
  – Call out to user code at defined points in packet processing
  – Replaces “conditional” configuration processing in DHCP4

• API design in progress

• Comments are more than welcome
http://bind10.isc.org/wiki/DhcpHooks
Possible features

Unfunded ideas

- Mutli-core support
- Prefix delegation in DHCPv6
- DHCPv6 failover
- DHCPv4 failover
- Different backends (Postgres? Cassandra?)
- CPE market
- ...
Interested?

**Fully open source model**
- ISC license (BSD-like), available for free
- GIT repo, trac tickets available
- Test, report bugs
- Submit patches

**Contribute**
- We are looking for sponsors (money and developers)
- Development contracts
- Review design documents (e.g. requirements)
Questions?
Thank you
isc.org