
Kea
Modern DHCP

The Kea Config Backend

Scalable DHCP configuration management with MySQL

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Some notes on Kea

- Modern DHCPv4 and DHCPv6 server (1.6 in Aug 2019)
- Performance (1000s leases/sec)
- High Availability, NETCONF, RADIUS
- Databases (CSV, MySQL, PostgreSQL, Cassandra)
- Hooks (ISC and 3rd party libraries)
- REST API (120+ commands and counting)

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The Backend Concept

DHCPv4, DHCPv6 server

MySQL

- Leases (addresses, prefixes)
- Host reservations (per host details)
- Options
  Pools
  Subnets
  Shared networks
  Option definitions
  Global parameters

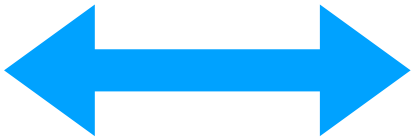
Lease Backend

Hosts Backend

Config Backend

Config Backend

Ability to retrieve configuration from a database

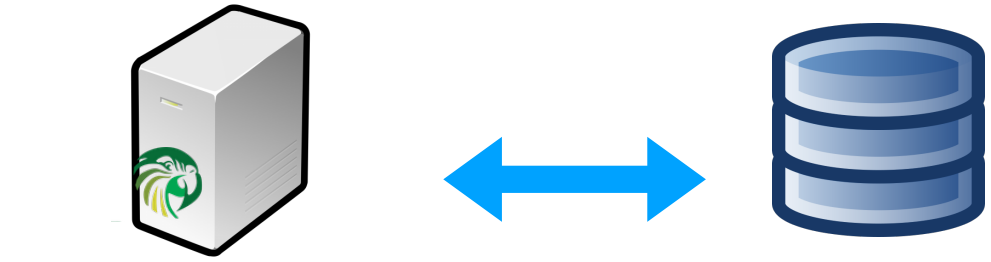


DHCPv4, DHCPv6 server

MySQL

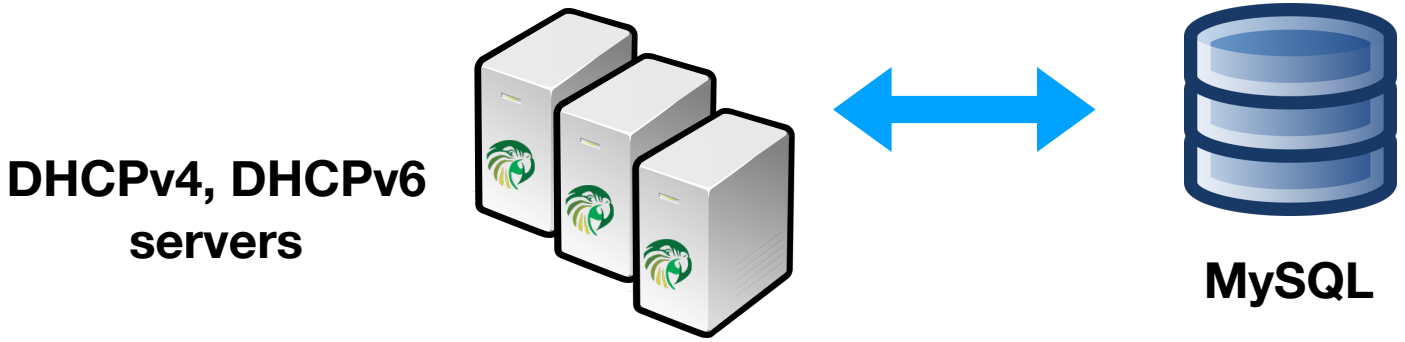
- Database stores DHCP configuration elements
- MySQL server can be colocated with DHCP or remote
- Multiple Kea servers can share one remote MySQL DB
- Database can be modified when DHCP servers are off-line

Capabilities



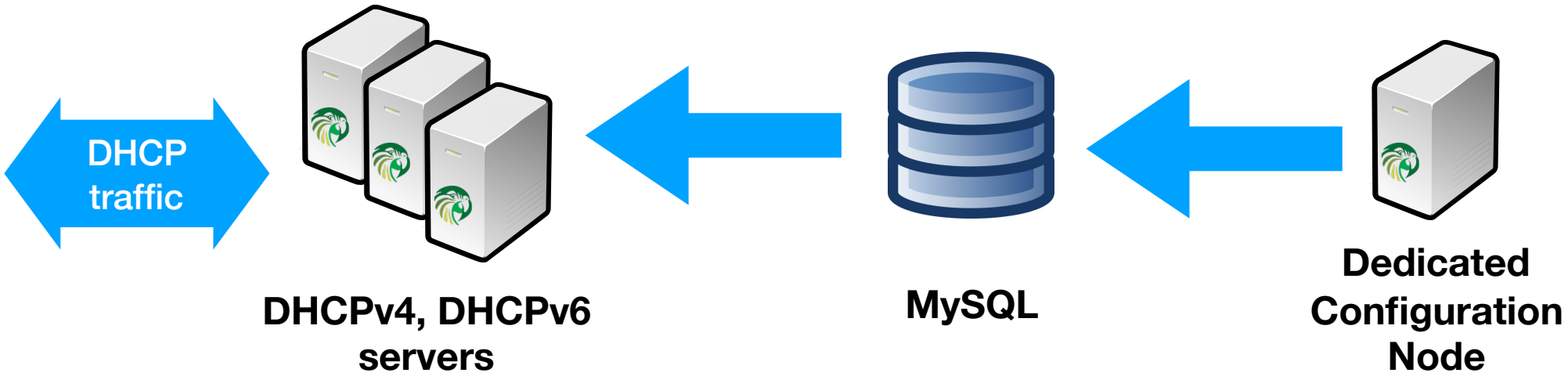
- Changes made to the configuration database are applied to all servers without needing to restart.
- Pull model with configurable delay:
  - `config-fetch-wait-time`

Local or remote



- MySQL can be colocated with DHCP or remote
- Multiple DHCP servers can share one MySQL instance
- Configuration database can co-exist with other databases

Offline Configuration



- Dedicated Kea node for configuration management
- Manage configuration even when servers are offline
- Allows firewalling of configuration management

Use Cases

- Sharing configuration between HA partners
- Frequently changing configuration
- Automated configuration management
- Large configuration / Large deployments
- Scaling up or down
- Database Monitoring, Reporting, Backup, Redundancy

Config Backend

- Currently MySQL only
  - PostgreSQL considered in a future release
- DHCPv4 and DHCPv6 servers only for now
  - DDNS, Control Agent, etc. are not (yet) supported
- Some parameters must be configured via the JSON configuration file
  - For example: `server-tag`

Minimalist Configuration

- Using the configuration backend, "hard-coded" configuration can be significantly reduced:

```
"server-tag"

"interfaces-config"

"control-socket"

"config-control"

"hooks-libraries"

"lease-database"

"expired-leases-processing"
```

Who am I?

Where am I?

How do I talk?

Where is my config?

Where do I store data?

When do I get rid of it?

Minimalist Configuration

- "Everything else" obtained from the Config Backend
  - Global Parameters
  - Option Definitions
  - Subnets & Shared Networks
  - Pools
  - Options

Communicating with Kea

- `kea-ctrl-agent`
  - Listens on a configurable TCP port
    - `http` - directly
    - `https` - reverse proxy (nginx)
  - Listens on a UNIX socket (per service)
  - Consumes and Emits JSON

{ JSON }

Enabling "Remote" Control

A sample `kea-ctrl-agent.conf` configuration file:

```
{
"Control-agent": {
    "http-host": "127.0.0.1",
    "http-port": 8080,

    "control-sockets": {
        "dhcp4": {
            "socket-type": "unix",
            "socket-name": "/tmp/kea-dhcp4.sock"
        },
        "dhcp6": {
            "socket-type": "unix",
            "socket-name": "/tmp/kea-dhcp6.sock"
        },
        "d2": {
            "socket-type": "unix",
            "socket-name": "/tmp/kea-dhcp-ddns.sock"
        }
    },
...
```

Multiplexed TCP
Communication here requires the service to be specified

UNIX Socket

Communicating with Kea

- `kea-shell`
  - Included with the Kea distribution
    - Built when configured with `--with-shell`
- `socat`
- `curl`
  - Available with most UNIX/Linux distributions

Communicating with Kea

- `kea-shell`

```
kea-shell --host 127.0.0.1  --port 8080 \
          --service dhcp4 config-get
```

- Postprocess
  - `| jq .`
  - `| python -m json.tool`

Communicating with Kea

- socat

```
echo '{ "command": "config-get" }' | \
   socat /tmp/kea-dhcp4.sock -,ignoreeof
```

- curl

```
curl -X POST -H "Content-Type: application/json" \
     -d '{ "command": "config-get",
           "service": [ "dhcp4" ] }' \
     http://127.0.0.1:8080/
```

Enabling Config Backend

A sample `kea-dhcp6.conf` configuration file:

```
"Dhcp6": {
    "server-tag": "headquarters",
    "config-control": {
        "config-databases": [{
            "type": "mysql",
            "name": "kea",
            "user": "kea",
            "password": "password",
            "host": "192.0.2.1",
            "port": 3306
        }],
        "config-fetch-wait-time": 20
    },
    "hooks-libraries": [{
        "library": "/lib/kea/hooks/libdhcp_mysql_cb.so"
    }, {
        "library": "/lib/kea/hooks/libdhcp_cb_cmds.so"
    }],
    ...
}
```

Server Tag

DB Credentials

Refresh Interval

CB Hook
where to look for config

CB Command Hook
exposes JSON-based REST API

Other DHCP6 Server Parameters

Command List

```
{
    “command”: “list-commands”,
    “service”: [ “dhcp6” ]
}
```

```
{
  "arguments": [
    "build-report",
    "config-get",
    "config-set",
    "config-test",
    "remote-global-parameter4-del",
    "remote-global-parameter4-get",
    "remote-global-parameter4-get-all”,
    . . .
    "remote-subnet6-list",
    "remote-subnet6-set",
    "shutdown",
    "statistic-{get,remove,reset}",
    "statistic-{get,remove,reset}-all",
    "version-get"
  ],
  "result": 0
}
```

Server Tags

- Server tags allow the creation of "groups" that are then be applied to one or more servers.
- Each server has exactly one server tag associated with it.
- Each object can have one or more server tags associated with it.
    - There is a global "all" tag that will be associated with all servers.

Server Tags

Given Objects with IDs and server tags as shown:

id: 100, server-tags: [“all”]

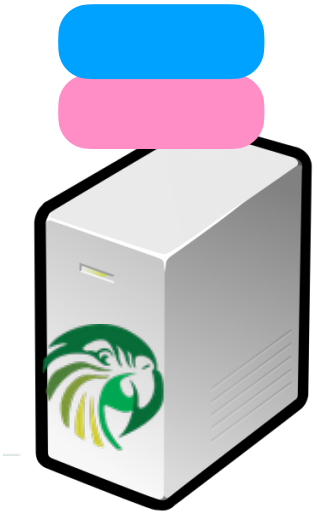
id: 101, server-tags: [“headquarters”]

id: 102, server-tags: ["headquarters", "remote"]

id: 103, server-tags: [“backup”]

id: 104, server-tags: [ ]

headquarters



backup

remote

Create Server Tags

```
#!/bin/bash
echo '"servers": [ {
             "server-tag": "headquarters",
             "description":  "The machine at HQ (v4)" } ]' | \
      kea-shell --host 127.0.0.1 --port 8080 --service dhcp4 \
             remote-server4-set | jq ""

echo '"servers": [ {
             "server-tag": "headquarters",
             "description": "The machine at HQ (v6)" } ]' | \
      kea-shell --host 127.0.0.1 --port 8080 --service dhcp6 \
              remote-server6-set | jq ""

echo '"servers": [ {
             "server-tag": "remote",
             "description":  "The machine in the field (v4)" } ]' | \
      kea-shell --host 127.0.0.1 --port 8080 --service dhcp4 \
             remote-server4-set | jq ""
[...]
```

Create Server Tags (output)

```
[
  {
    "arguments": {
      "servers": [
        {
          "description": "The machine at HQ (v4)",
          "server-tag": "headquarters"
        }
      ]
    },
    "result": 0,
    "text": "DHCPv4 server successfully set."
  }
]
[...]
```

Get all DHCP4 Server Tags

```
{
    "command":
        "remote-server4-get-all",
    "service": [ "dhcp4" ]
}
```

```
{
  "arguments": {
    "count": 2,
    "servers": [
      {
        "description": "The machine at HQ (v4)",
        "server-tag": "headquarters"
      },
      {
        "description": "The machine in the field (v4)",
        "server-tag": "remote"
      }
    ]
  },
  "result": 0,
  "text": "2 DHCPv4 server(s) found."
}
```

Create IPv6 Subnet

```
{
  "subnets": [
    {
      "id": 100,
      "subnet": "2001:db8:1::/48",
      "shared-network-name": "",
      "pools": [
        {
          "pool": "2001:db8:1::/64"
        }
      ]
    }
  ],
  "server-tags": [
    "remote"
  ],
  "command": "remote-subnet6-set"
}
```

```
{
   "arguments": {
     "subnets": [
       {
         "id": 100,
         "subnet": "2001:db8:1::/48"
       }
     ]
   },
   "result": 0,
   "text": "IPv6 subnet successfully set."
 }
```

Get a specific Net by ID

```
{
 "command":
       "remote-subnet6-get-by-id",
  "subnets": [ { "id": 100 } ]
}
```

```
 {
   "arguments": {
     "count": 1,
     "subnets": [
       {
         "id": 100,
         "metadata": {
           "server-tags": [
             "remote"
           ]
         },
         "option-data": [],
         "pd-pools": [],
         "pools": [
           {
             "option-data": [],
             "pool": "2001:db8:1::/64"
[...]
   "result": 0,
   "text": "IPv6 subnet 100 found."
 }
```

List All IPv6 Subnets (tag)

```
{
  "server-tags": [ "all" ],
  "command": "remote-subnet6-list"
}
```

```
  {
    "arguments": {
      "count": 4,
      "subnets": [
        {
          "id": 101,
          "metadata": {
            "server-tags": [
              "all"
            ]
          },
          "shared-network-name": null,
          "subnet": "2001:db8:2::/48"
        },
    },
[...]
    "result": 0,
    "text": "4 IPv6 subnet(s) found."
  }
```

Create an Option Definition

```
{
  "command": "remote-option-def4-set",
  "arguments": {
    "option-defs": [
      {
        "name": "foo",
        "code": 222,
        "type": "uint32",
        "array": false,
        "record-types": "",
        "space": "dhcp4",
        "encapsulate": ""
      }
    ]
  },
  "server-tags": [
    "headquarters",
  ]
}
```

```
[
  {
    "arguments": {
      "option-defs": [
        {
          "code": 222,
          "space": "dhcp4"
        }
      ]
    },
    "result": 0,
    "text": "DHCPv4 option definition
        successfully set."
  }
]
```

Get an Option Definition

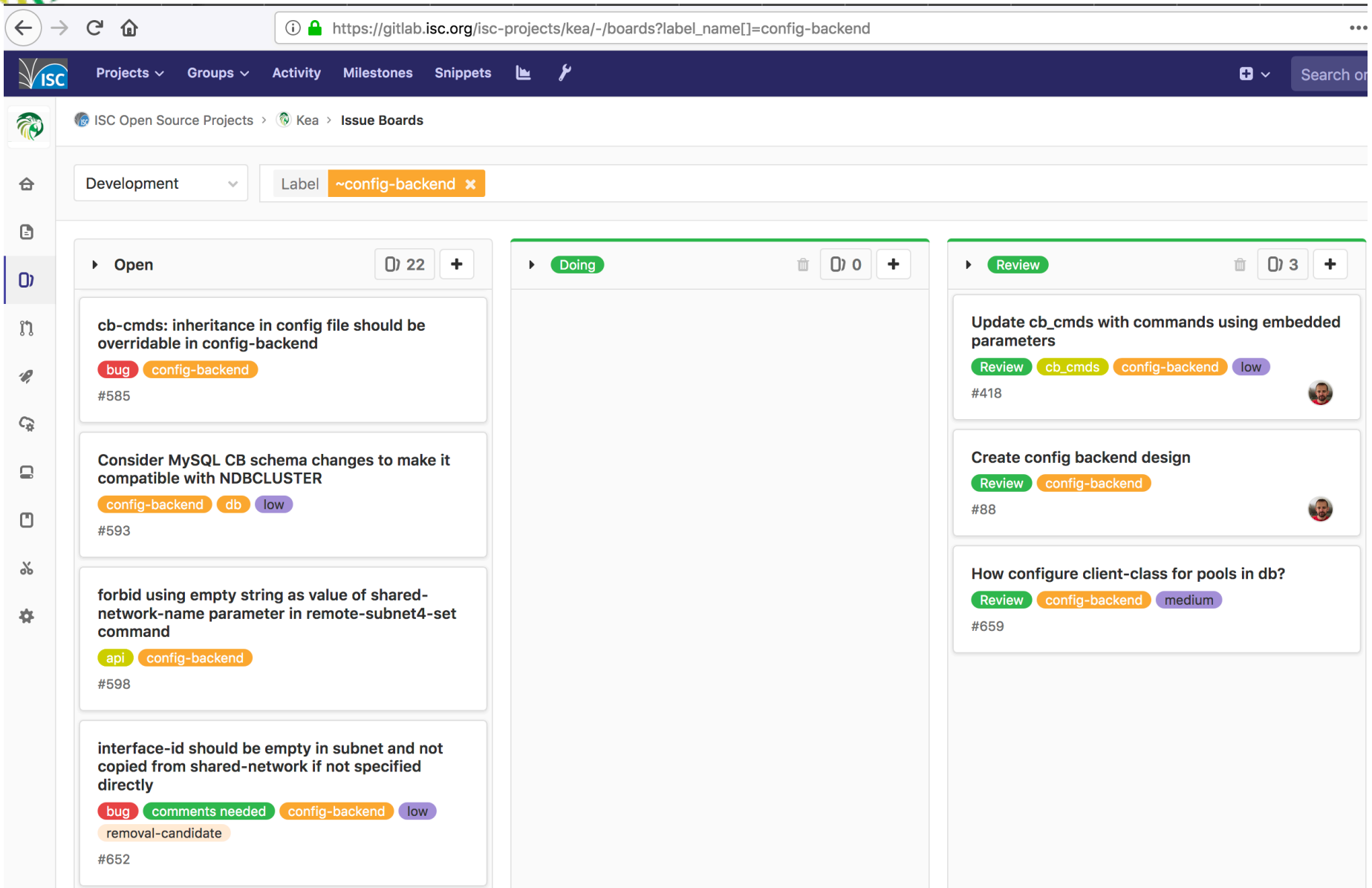
```
{
  "command": "remote-option-def4-get",
  "arguments": {
    "option-defs": [
      {
        "code": 222,
        "space": "dhcp4"
      }
    ],
    "server-tags": [
      "headquarters"
    ]
  },
  "service": [
    "dhcp4"
  ]
}
```

```
 {
   "arguments": {
     "count": 1,
     "option-defs": [
       {
         "array": false,
         "code": 222,
         "encapsulate": "",
         "metadata": {
           "server-tags": [
             "headquarters"
           ]
         },
         "name": "foo",
         "record-types": "",
         "space": "dhcp4",
         "type": "uint32"
       }
     ]
   },
   "result": 0,
   "text": "DHCPv4 option definition 222 in
'dhcp4' found."
 }
```

Moving to Config Backend

- Moving from a non-database configuration to the Config Backend requires understanding of the existing infrastructure
  - Common elements must be pulled out of existing configurations and grouped
- This will be a topic for a future webinar!

Feedback requested



https://gitlab.isc.org/isc-projects/kea/-/boards?label_name[]=config-backend

Questions?

Comments?

kea.isc.org

gitlab.isc.org/isc-projects/kea