Kea DHCP

Migrating to Kea from ISC DHCP

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- Kea Migration Assistant (KeaMA)
- Differences between Kea and ISC DHCP
- Manual Migration
- ISC DHCP to Kea DHCP Migration Plan

Software Migrations

About migrations

- Migrations from old to new software products are required from time to time
- Not all software can be upgraded to new functionality
    - Sometimes a clean start is needed to update the underlying implementation
    - Such new implementations often cannot provide 100% compatibility
    - Examples: BIND 8 -> BIND 9, Python2 -> Python3, ISC DHCP -> Kea DHCP

Migration strategies

- Possible migration strategies
    - Upgrade of the existing infrastructure
    - Re-design of the existing infrastructure

Re-Design of an existing infrastructure

- A re-design can be used to remove shortcomings of the old design
  - A migration is a good time to review the current design
  - A new design can make use of modern features that were not available at the time of the original design
  - Maybe it is time to introduce IPv6?
  - Implement new features
    - Automatic configuration management
    - Monitoring
    - Better documentation

Configuration migration

- A DHCP configuration can be quite complex
  - Migrating such a configuration can be challenging
  - There could be unknown pitfalls
  - Testing and Monitoring are important (the Kea DHCP team has created tools to help with this)

About automated configuration migration

- Automated migration of an existing DHCP configuration might be possible
- But be aware:
    - Automated migrations don't utilize the power of the new system
    - Automated migrations create a non-optimal configuration that might be harder to maintain

- Recommendation: if possible, **take time and do a manual migration**

Kea Migration Assistant (KeaMA)

Kea Migration Assistant (KeaMA)

- The Kea Migration Assistant (KeaMA) is a tool provided by ISC to help migrating an existing ISC DHCP configuration to Kea DHCP
    - The output of KeaMA can be used as a starting point for creating a Kea DHCP configuration
    - Don't expect miracles from KeaMA: in most cases, it will not be able to convert the complete ISC DHCP configuration

What KeaMA can do

- KeaMA is good at converting simple configuration structures
    - Reservations
    - Subnet and Shared-Network definitions
    - DHCP Option definitions

What KeaMA cannot do

- There are some ISC DHCP configuration statements that cannot be translated into a Kea DHCP configuration
    - configurations where ISC DHCP and Kea DHCP differ
        - Failover vs. High-Availability
        - Support for hardware types other than Ethernet
        - Shared-Network pools
        - ISC DHCP spawning classes
        - ...

Building Kea Migration Assistant (KeaMA)

- KeaMA is part of the ISC DHCP Server
  - It reuses the ISC DHCP configuration file parser
  - ISC provides experimental RPM/DEB packages on Cloudsmith: https://cloudsmith.io/~isc/repos/keama/packages/
  - It is recommended to install and use KeaMA on a dedicated *migration* machine
    - Copy the ISC DHCP configuration to that machine and migrate the configuration there

KeaMA: getting the source

- Download the latest ISC DHCP source code and extract the tar file

```
wget http://ftp.isc.org/isc/dhcp/4.4.2/dhcp-4.4.2.tar.gz
tar xvfz dhcp-4.4.2.tar.gz
```

KeaMA: preparing the source

- The KeaMA source must be adjusted to be compiled on your Linux/Unix system and hardware architecture
    - the **`configure`** script will check the running operating system and will create the build files required to compile KeaMA

```
cd dhcp-4.2.2/
./configure
```

KeaMA: Compile from source

- Once the **`configure`** script returns without error, the KeaMA tool can be build

```
cd keama
make
```

KeaMA: using KeaMA

- It is not required to *install* KeaMA, it can be used directly from the build directory
- KeaMA syntax

```
keama [ -4 | -6] [ -D ] [ -N ] [ -r {perform|fatal|pass} ] \
  [ -l hook-library-path ] [ -i input-file ] [ -o output-file ]
```

KeaMA: Example usage

- This is an example of using KeaMA on an ISC DHCPv4 configuration file
    - the option `-N` will place host reservations in the appropriate subnet
    - The option `-r pass` will pass host names into the Kea DHCP configuration. Often these host names need to be replaced with their IP addresses manually.

```
./keama -4 -N -r pass -i dhcpd.conf -o kea-dhcp4.conf
```

KeaMA: example result

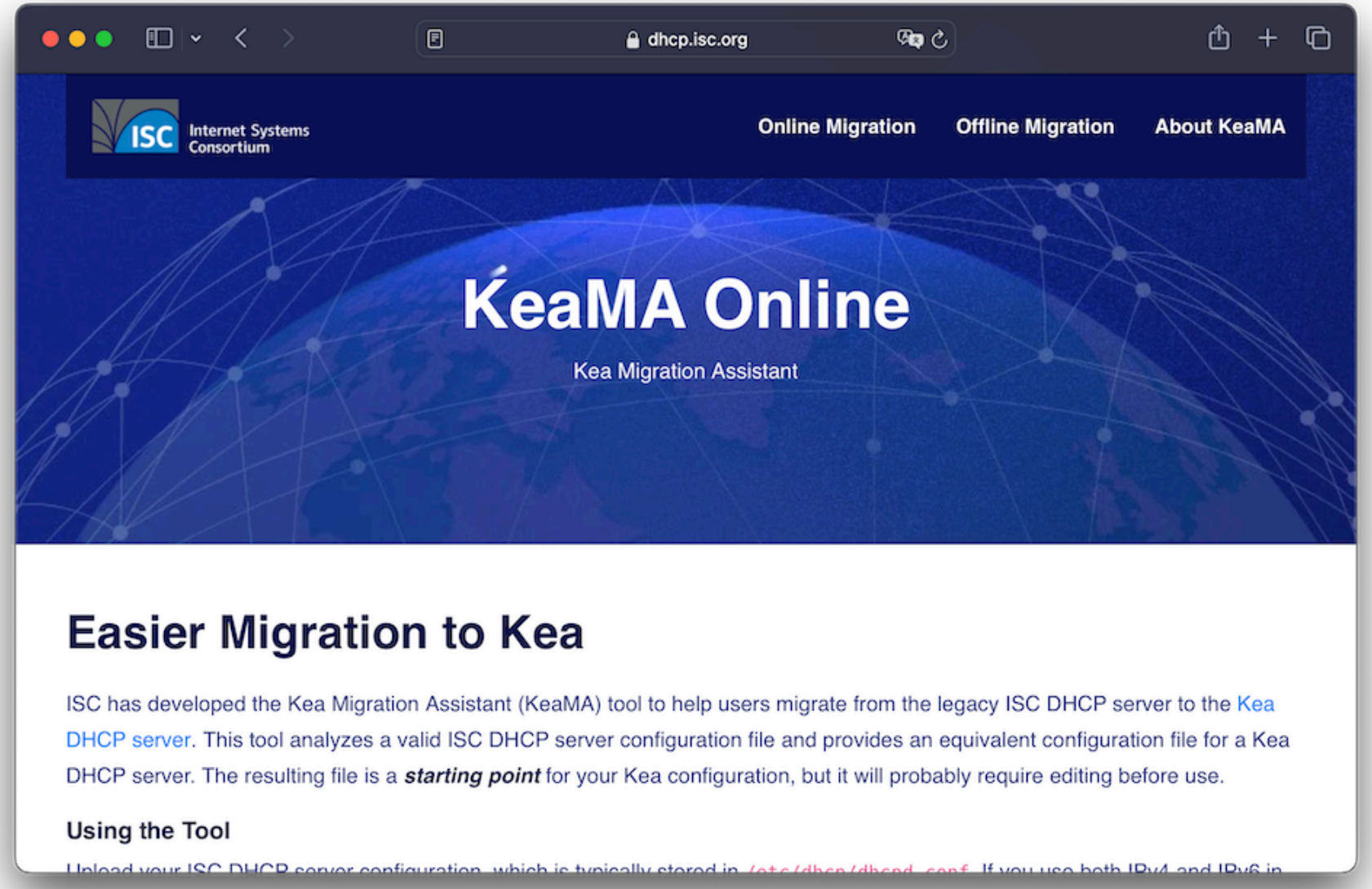
- Comments point to parts of the configuration that most likely need manual adjustment
- Known issues are referenced with their Gitlab issue number
    - Example: Issue #245 below can be found at https://gitlab.isc.org/isc-projects/kea/-/issues/245

```
{
  # dhcpd.conf
  /// This configuration declares some subnets but has no interfaces-config
  /// Reference Kea #245
  "Dhcp4": {
//  "statement": {
//    "config": {
//      "value": "allow",
//      "name": "allow-booting",
//      "code": 9
//    }
//  },
    "dhcp-ddns": {
      "qualifying-suffix": "home.example.com",
      "enable-updates": true
```

```
    },
[...]
```

KeaMA online

- ISC provides an online Kea migration service at https://dhcp.isc.org
    - This service runs the `keama` tool in the background and can ISC DHCP configuration to Kea DHCP JSON configuration. files


dhcp.isc.org
ISC
Internet Systems Consortium
Online Migration
Offline Migration
About KeaMA
KeaMA Online
Kea Migration Assistant
Easier Migration to Kea
ISC has developed the Kea Migration Assistant (KeaMA) tool to help users migrate from the legacy ISC DHCP server to the Kea DHCP server. This tool analyzes a valid ISC DHCP server configuration file and provides an equivalent configuration file for a Kea DHCP server. The resulting file is a starting point for your Kea configuration, but it will probably require editing before use.
Using the Tool

Differences between Kea and ISC DHCP

Shared Networks

- ISC DHCP permits pools at shared-network level
- In Kea DHCP, a pool must belong to a subnet
- In Kea DHCP, selecting a lease from a shared-network has a performance penalty compared to selecting a lease from a plain subnet

Client classification

- Kea DHCP does not have a concept similar to **`permit`** or **`deny`** in ISC DHCP
    - In ISC DHCP, this is used to permit or deny certain client classes in subnets
    - This can be done in Kea DHCP as well, but the logic is different

- Kea DHCP does support ***spawning*** classes (which are used for dynamic lease limit configurations), but the configuration is different from ISC-DHCP (see video Kea DHCP Template Classes - https://www.youtube.com/watch?v=v7CA834WhMo)

DHCP Options

- ISC DHCP can resolve DNS names to IP addresses for options that require an IP address. Kea DHCP does not resolve DNS names
    - The Kea Migration Assistant can resolve the DNS names into IP addresses while converting an ISC DHCP configuration

- Option inheritance scoping is different between ISC DHCP and Kea DHCP

High-Availability

- ISC DHCP supports the IETF DHCPv4 Failover Protocol draft https://datatracker.ietf.org/doc/html/draft-ietf-dhc-failover
- Kea DHCP supports its own DHCP high availability implementation for DHCPv6 and DHCPv4
- Both create a highly available DHCP service, but the implementation and configuration details are different
- Document comparing failover in ISC DHCP to HA in Kea DHCP https://kb.isc.org/docs/aa-01617

Kea High Availability vs ISC DHCP Failover (1)

- Number of servers in an HA cluster
  - ISC DHCP: 2
  - Kea DHCP: 2 active + unlimited backup servers
- Failover relationships
  - ISC DHCP: one per subnet
  - Kea DHCP: one per instance
- Load balancing
  - ISC DHCP: Flexible split (RFC3074)
  - Kea DHCP: fixed 50/50 split (RFC3074)

Kea High Availability vs ISC DHCP Failover (2)

- Lazy lease updates (MCLT)
  - ISC DHCP: yes (server responds to the client immediately)
  - Kea DHCP: no (server waits for lease update completion before responding to client)
- Send lease updates to external entity
  - ISC DHCP: no
  - Kea DHCP: yes (via backup server or custom hook library)
- Rebalancing pools
  - ISC DHCP: yes
  - Kea DHCP: no

Kea High Availability vs ISC DHCP Failover (3)

- Database replication for sharing lease info
    - ISC DHCP: no
    - Kea DHCP: yes (optional)
- API
    - ISC DHCP: omapi
    - Kea DHCP: RESTful API

Host reservations

- In ISC DHCP all host declarations are global
- Kea DHCP supports global and per-subnet/shared-network reservations
- ISC DHCP can have reservations that are not viable on the subnet where the clients are attached
    - Kea does not start if configured with an address or prefix that is not viable on its subnet; it displays an error

Scripts and Tools

- Most 3rd party tools and scripts that work with ISC DHCP do not work with Kea DHCP
    - parse lease file
    - SNMP monitoring agents
    - Configuration orchestration
- Many use cases are covered by the Kea API

Manual Migration

Client Classes

- The Kea Migration Assistant will translate the client classification rules from ISC DHCP to Kea DHCP
    - the Kea DHCP configuration will have the original client classification as a comment

```
[...]
    "client-classes": [
      {
        "name": "virtualbox",
        /// from: match if (substring(hardware, 1, 3)) = 0x080027
        "test": "substring(pkt4.mac,0,3) == 0x080027"
      },
[...]
```

- Understanding Client Classification
  https://kb.isc.org/docs/understanding-client-classification

Client Classes

- Review and, if possible, simplify the client classification tests
  - Kea DHCP might have expressions that better define the class
  - Using Expressions in Classification: https://kea.readthedocs.io/en/latest/arm/classify.html#using-expressions-in-classification

```
[...]
      {
        "name": "gen#virtualbox#!KNOWN#_AND_#!microsoft-client#",
        "test": "(member('virtualbox') or not member('KNOWN')) and not member('microsoft-clie
      },
      {
        "name": "gen#!KNOWN#_AND_#!virtualbox#!microsoft-client#",
        "test": "(not member('KNOWN')) and not member('virtualbox') and not member('microsoft
      }
[...]
```

Expressions

- ISC DHCP allows complex expressions in the configuration file
  - The ISC DHCP configuration file is almost a programming language
  - Most effects of ISC DHCP expressions can be created with the Kea DHCP functions, or existing hook libraries (`flex_id` or `flex_option` hooks)
  - In other cases, a custom hook can be used to implement almost any logic required
    - 3rd party hook examples: https://github.com/search?q=kea+hook

Custom Kea hooks

- Repositories 11
- Code ?
- Commits 387
- Issues 149
- Discussions Beta 0
- Packages 0
- Marketplace 0
- Topics 1
- Wikis 1
- Users 0

Languages

- C++ 8
- Dockerfile 1
- Python 1
- Shell 1

Advanced search Cheat sheet

11 repository results

Sort: Best match

zorun/kea-hook-runscript

This a **hook** for the **Kea** DHCP server that allows to run an external script at various points in the processing of DHCP...

☆ 39 C++ MPL-2.0 license Updated on Sep 3

Olen/kea_hooks

☆ 6 C++ Updated on May 12, 2016

michaelgugino/kea-pxe-replace-mod

Kea module utilizing **hooks** api to replace pxe options (next server, file) via web request

☆ 19 C++ BSD-3-Clause license Updated on Dec 23, 2016

serverzone/Kea-dhcp-hooks

Kea DHCP **hooks**

☆ 1 C++ MIT license Updated on Mar 14, 2019

cvut/kea-hook-userchk-ldap

Kea DHCP **hook** for checking user access in LDAP

dhcp kea kea-dhcpd kea-hook

☆ 1 C++ MPL-2.0 license Updated on Feb 5

pilotsanya/kea-hook-opt82

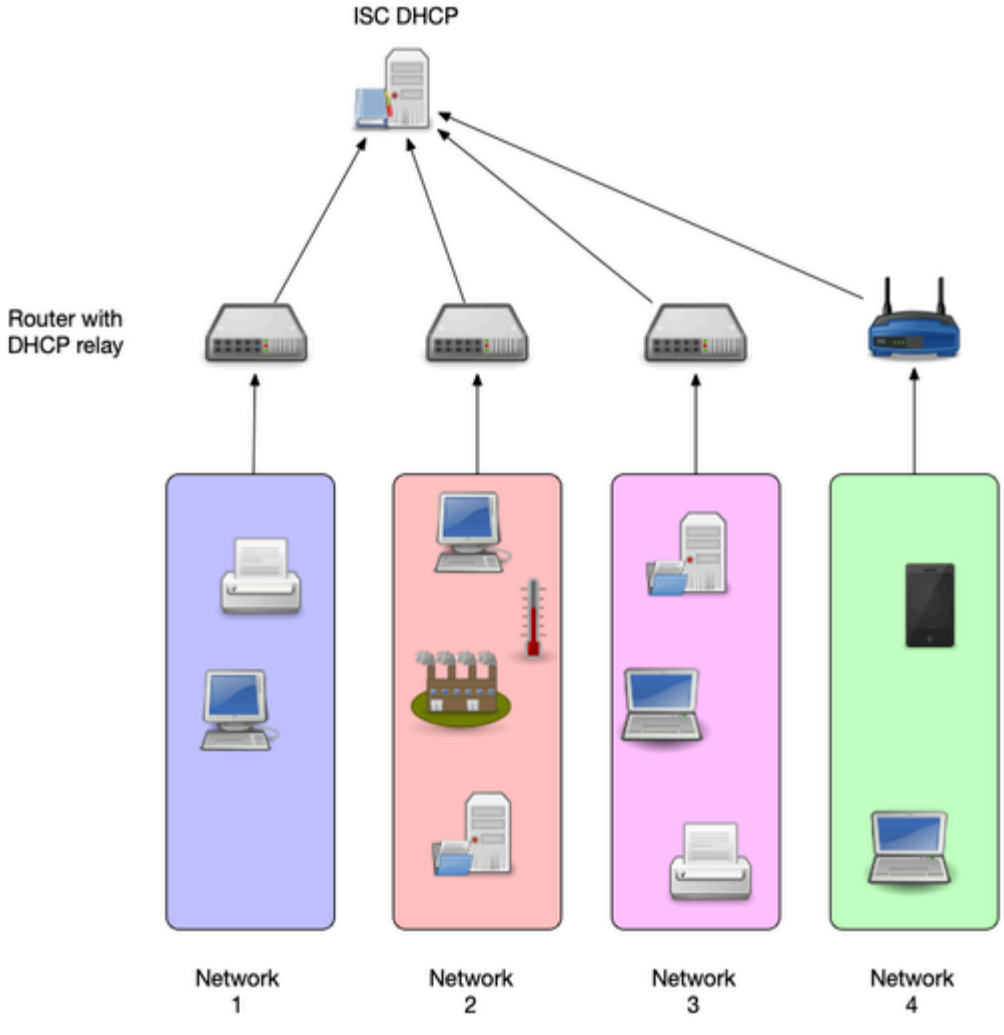
The **hook** changes option 61 and generates flex-id from option 82

hook kea option82 flex-id

☆ 1 C++ Updated on Jul 22, 2019

ISC DHCP to Kea DHCP Migration Plan

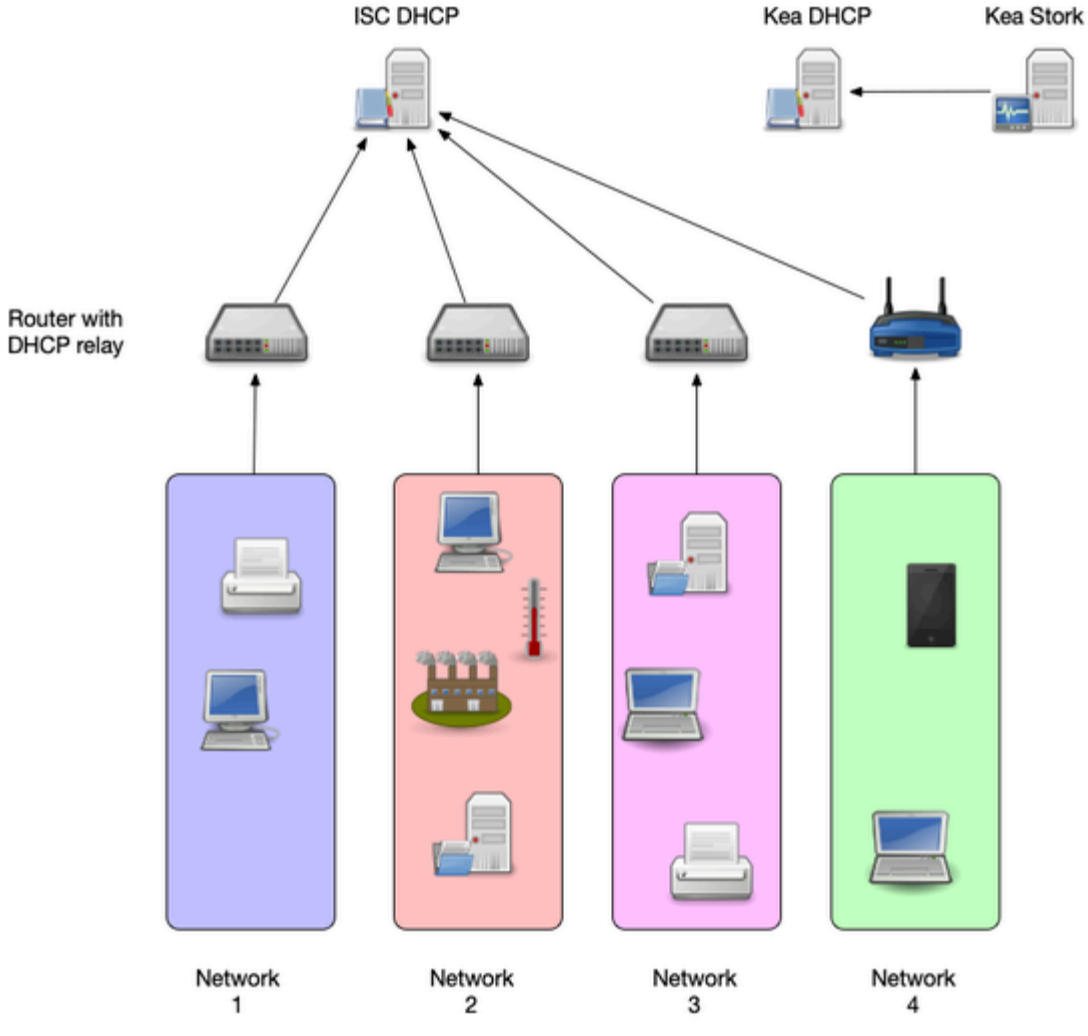
Proposed migration steps



Proposed migration steps

- Get familiar with Kea DHCP
  - Run a production Kea DHCP for some time (some weeks) in a small and low risk network
  - Test features that will be used in the larger production networks

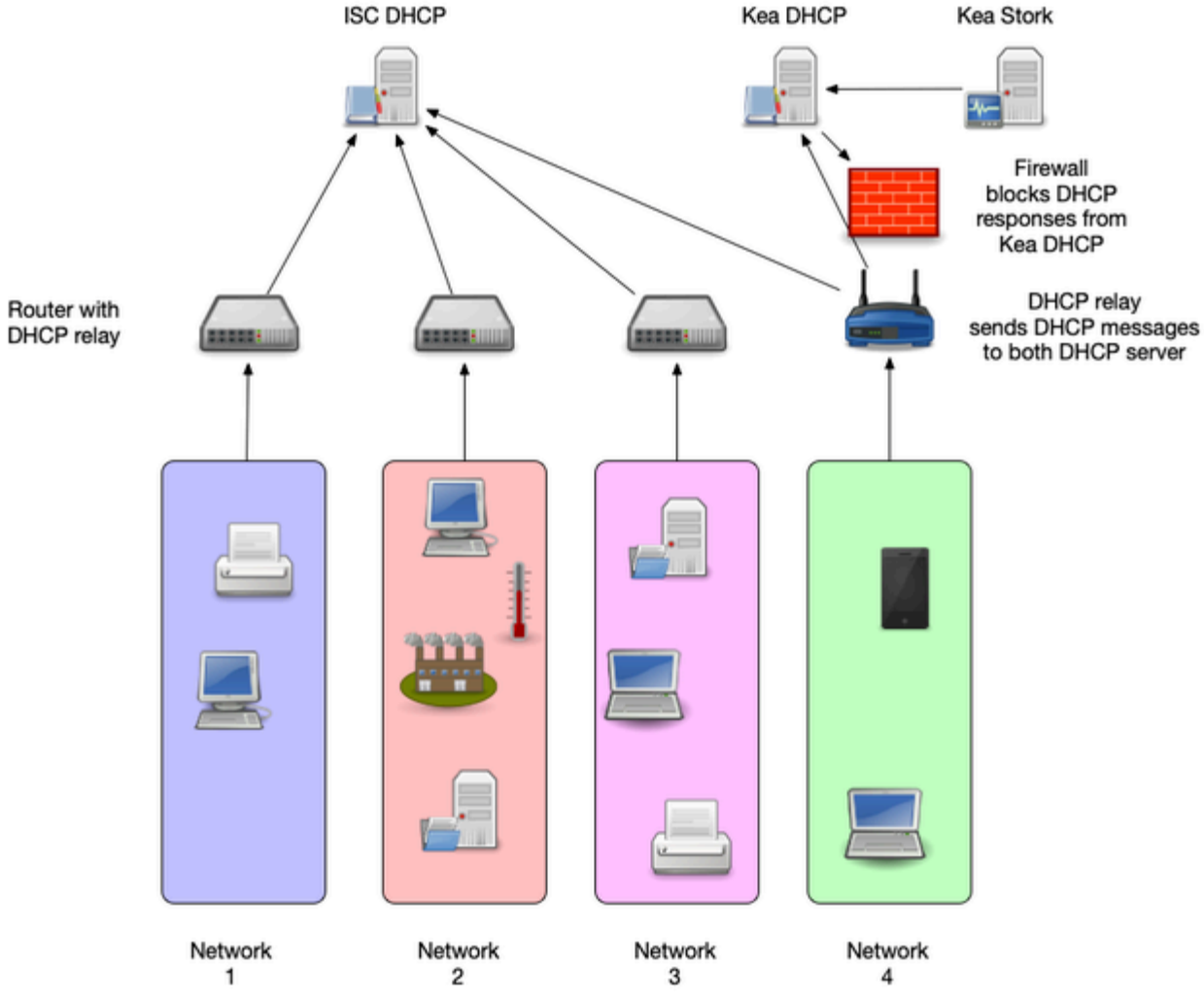
Proposed migration steps



Proposed migration steps

- Install Kea DHCP alongside the existing ISC DHCP
- Write and test the Kea DHCP configuration
    - Configure the DHCP relays to forward DHCP messages to ISC DHCP (production) and Kea DHCP (test)
        - Block the responses from Kea DHCP in the host firewall of the Kea DHCP OS (for example Linux nftables)
        - Inspect the responses from Kea DHCP and compare with the responses from ISC DHCP
- Implement Logging and Monitoring

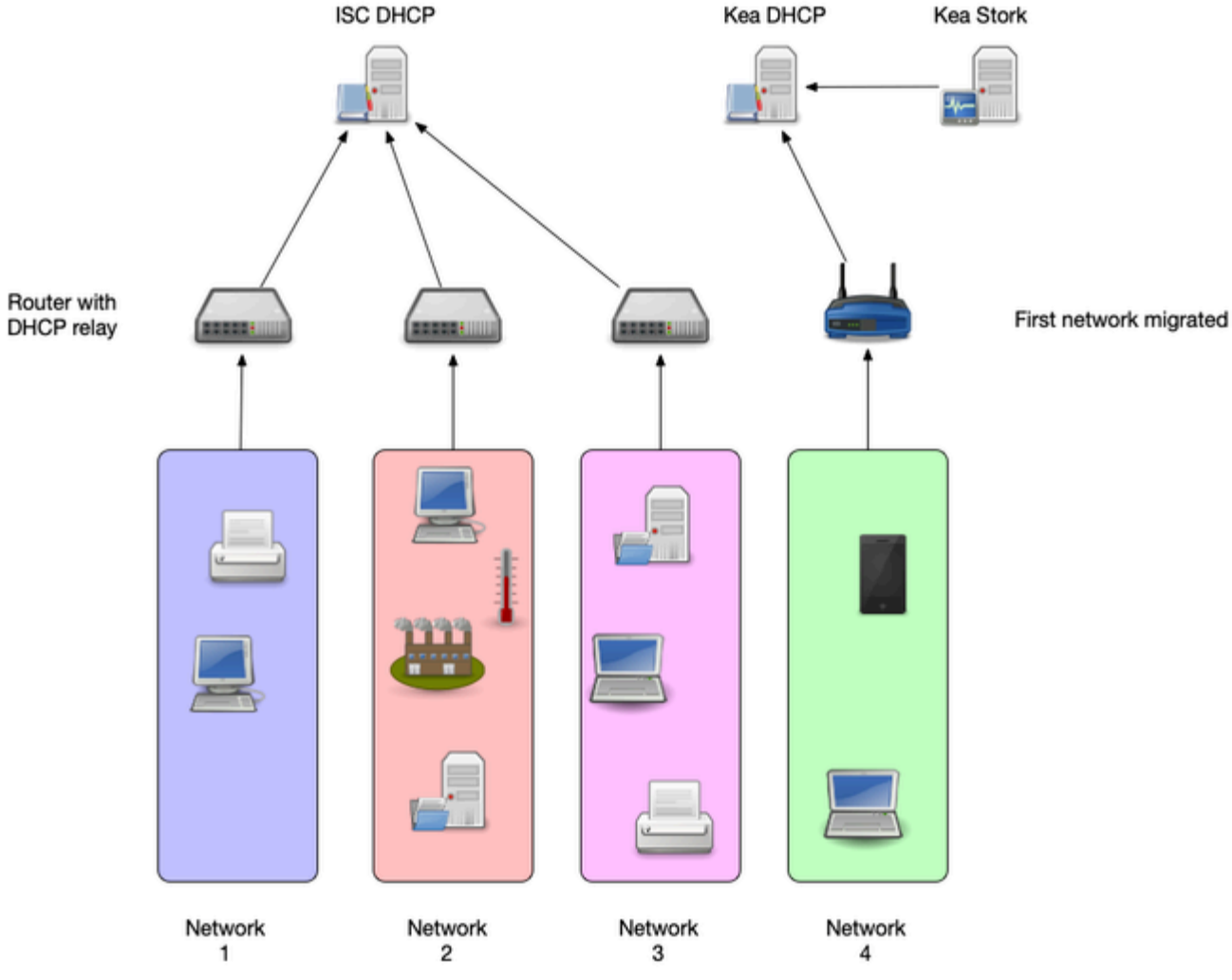
Proposed migration steps



Proposed migration steps

- Define the time line for the migration
- Lower the lease/refresh times on the ISC DHCP before the migration
    - One hour DHCP refresh is safe for most devices
    - Modern operating systems (Windows, Linux, macOS etc) can work with low DHCP refresh times, such as 5 minutes
    - Embedded or older DHCP clients (MS-DOS, Windows 9x, QNX etc) that can be found in industrial control units need safe refresh values

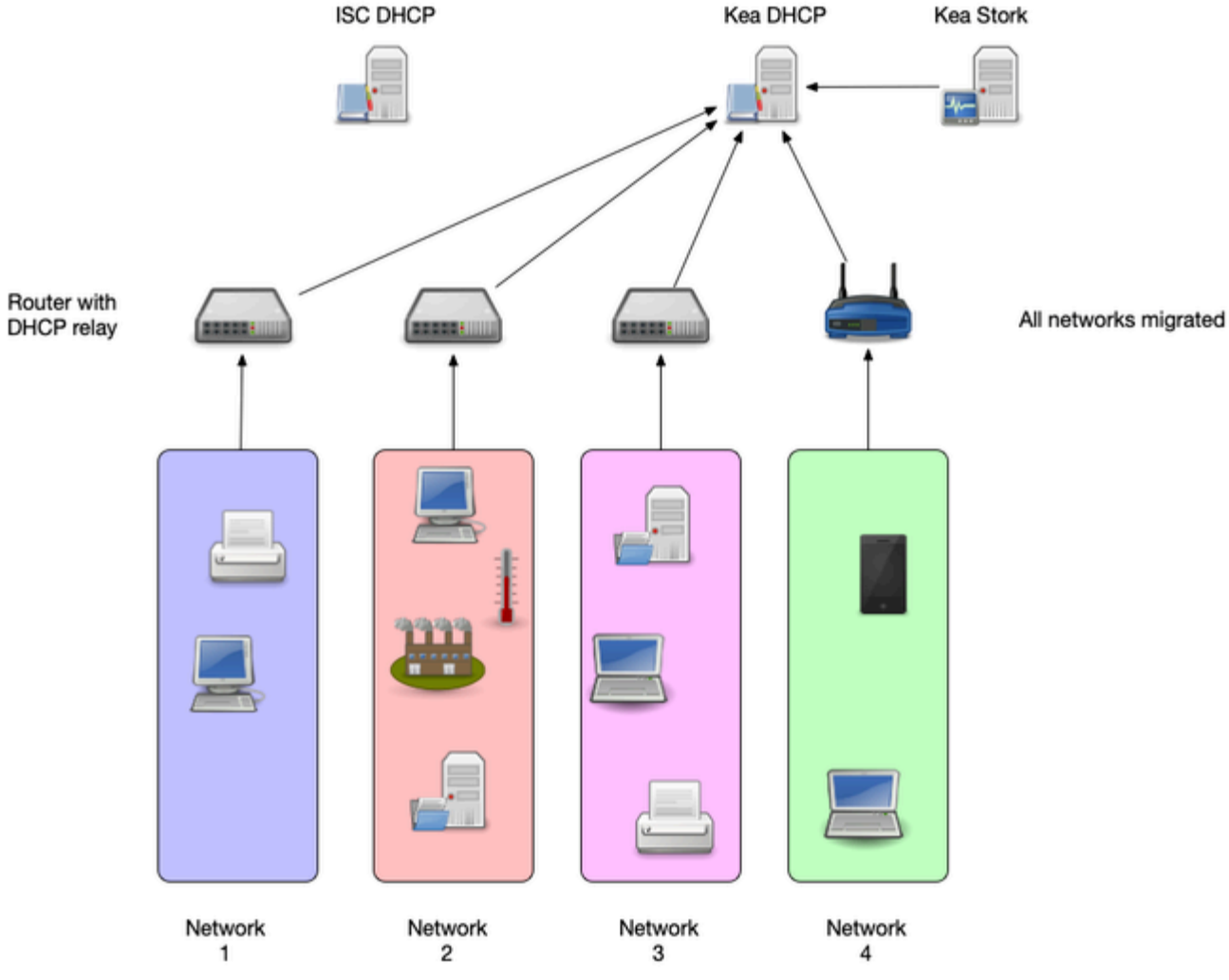
Proposed migration steps



Proposed migration steps

- Start with a ***friendly crowd***, low risk network (IT department WLAN)
- Switch networks one-by-one via DHCP relay configuration
    - On regression, switch back to ISC DHCP for this one network and investigate

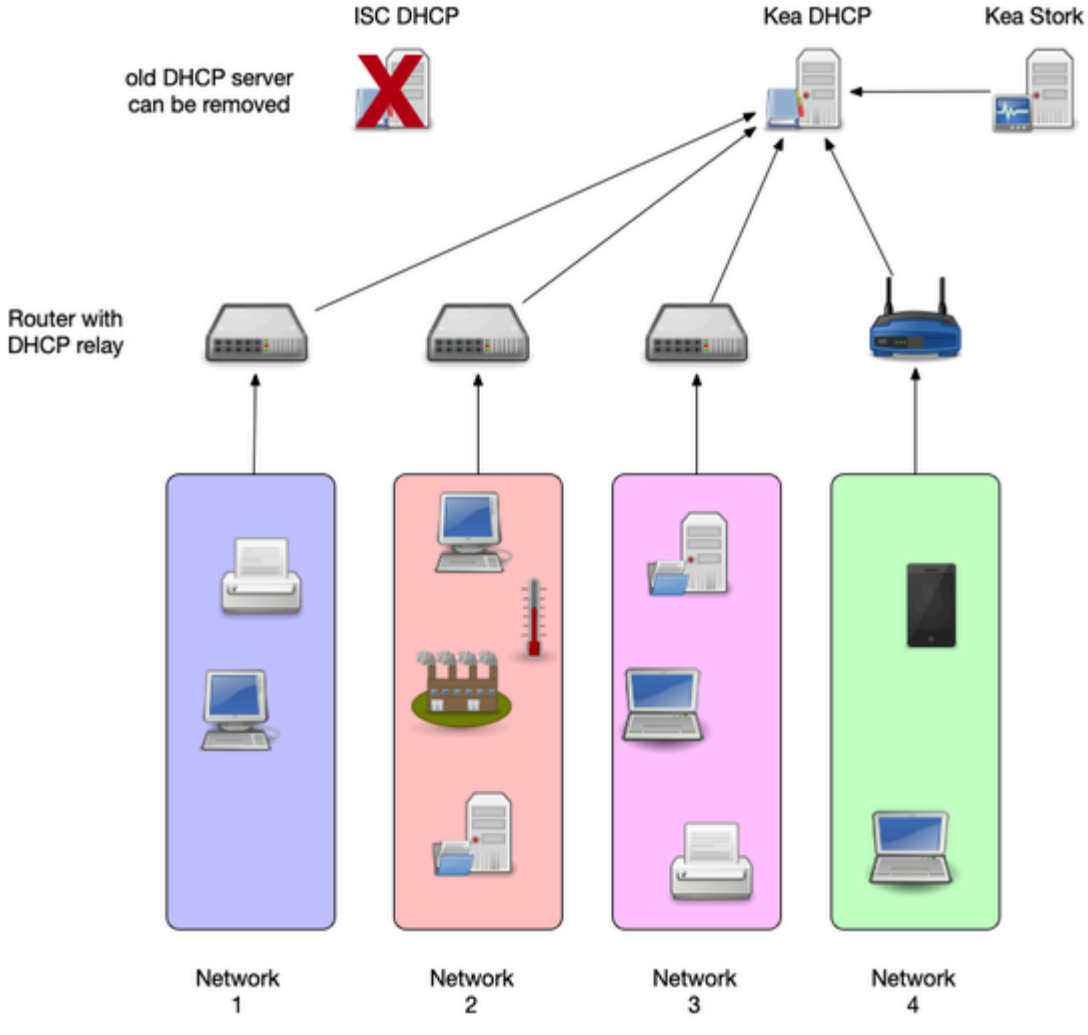
Proposed migration steps



Proposed migration steps

- Monitor leases on the ISC DHCP as well
  - At some point in time, there should be no DHCP requests coming to the old server(s)
  - Time to shut the old systems down

Proposed migration steps



Resources

- Alan Clegg – NANOG 76 - DHCP Migration to Kea
  - https://pc.nanog.org/static/published/meetings/NANOG76/19
- Kea High Availability vs ISC DHCP Failover
  - https://kb.isc.org/docs/aa-01617
- Kea HA Design Document
  - https://gitlab.isc.org/isc-projects/kea/-/wikis/designs/High-A
- Available 3rd party hooks for Kea DHCP
  - https://gitlab.isc.org/isc-projects/kea/-/wikis/Hooks-available
- Using Host Reservations in Kea
  - https://kb.isc.org/docs/what-are-host-reservations-how-to-use