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# Migrating to Kea DHCP

A DHCP Service that is fun to work with

**Carsten Strotmann and the ISC Team**

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# Welcome

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Welcome to our Webinar on migrating to Kea DHCP  
(from ISC DHCP or other DHCP services)

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## In this Webinar



- Getting to know the existing DHCP implementation
- De-fragment the network
- The choice to be made: Kea high availability
- Planning the change
- Step-by-Step migrations

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## Previous Webinars



- Using the Kea DHCP Server - Session 6 of 6.  
Migrating to Kea from ISC DHCP  
(<https://www.youtube.com/watch?v=kEZ4P3NAibI>)  
covers technical differences between ISC DHCP and Kea DHCP
- Configuring vendor options in Kea DHCP  
(<https://www.youtube.com/watch?v=mcXO7E9K190>)  
discusses how to migrate custom vendor options from ISC DHCP to Kea DHCP

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# The existing DHCP implementation

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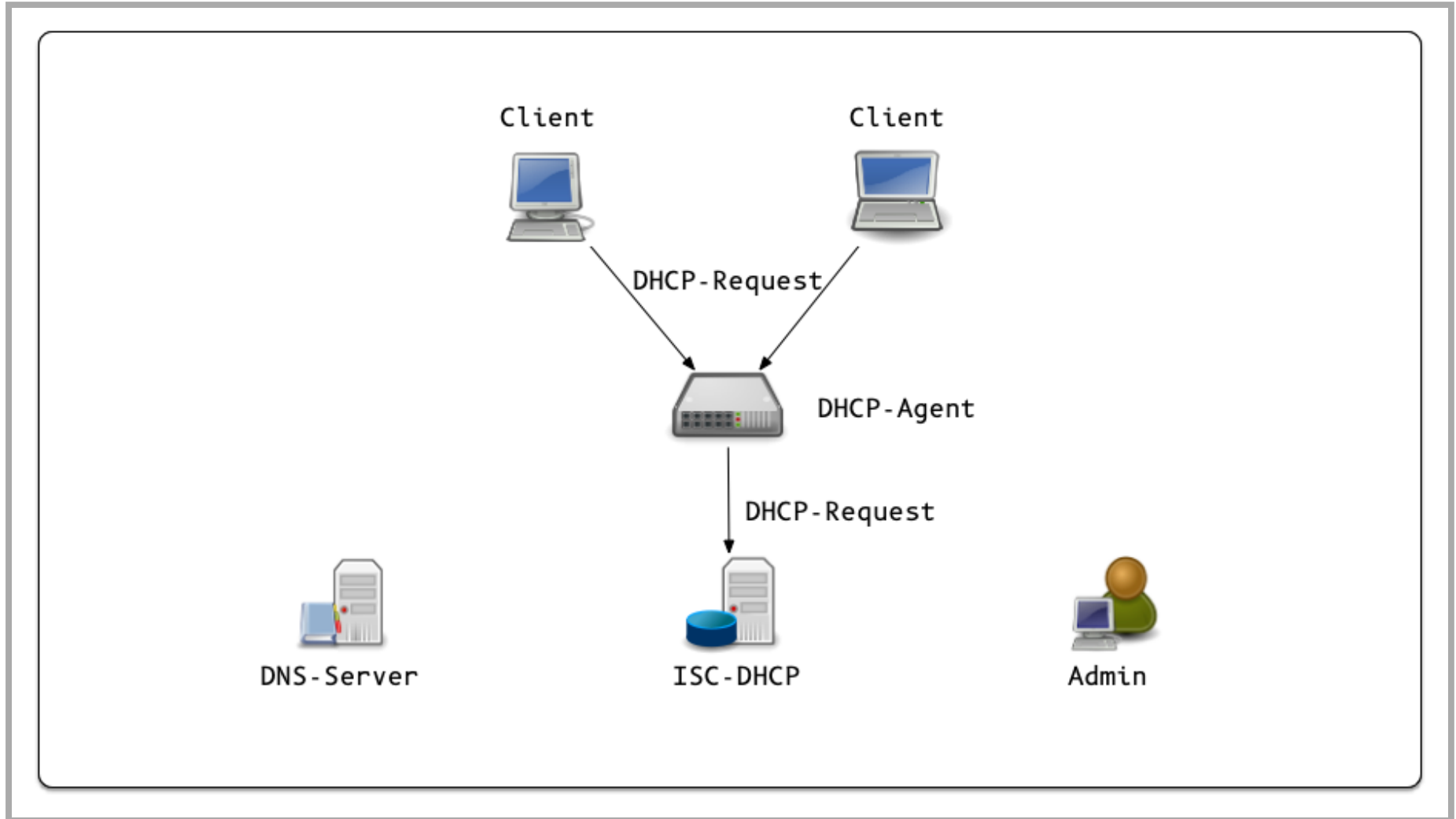
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## ISC-DHCP vs Kea-DHCP

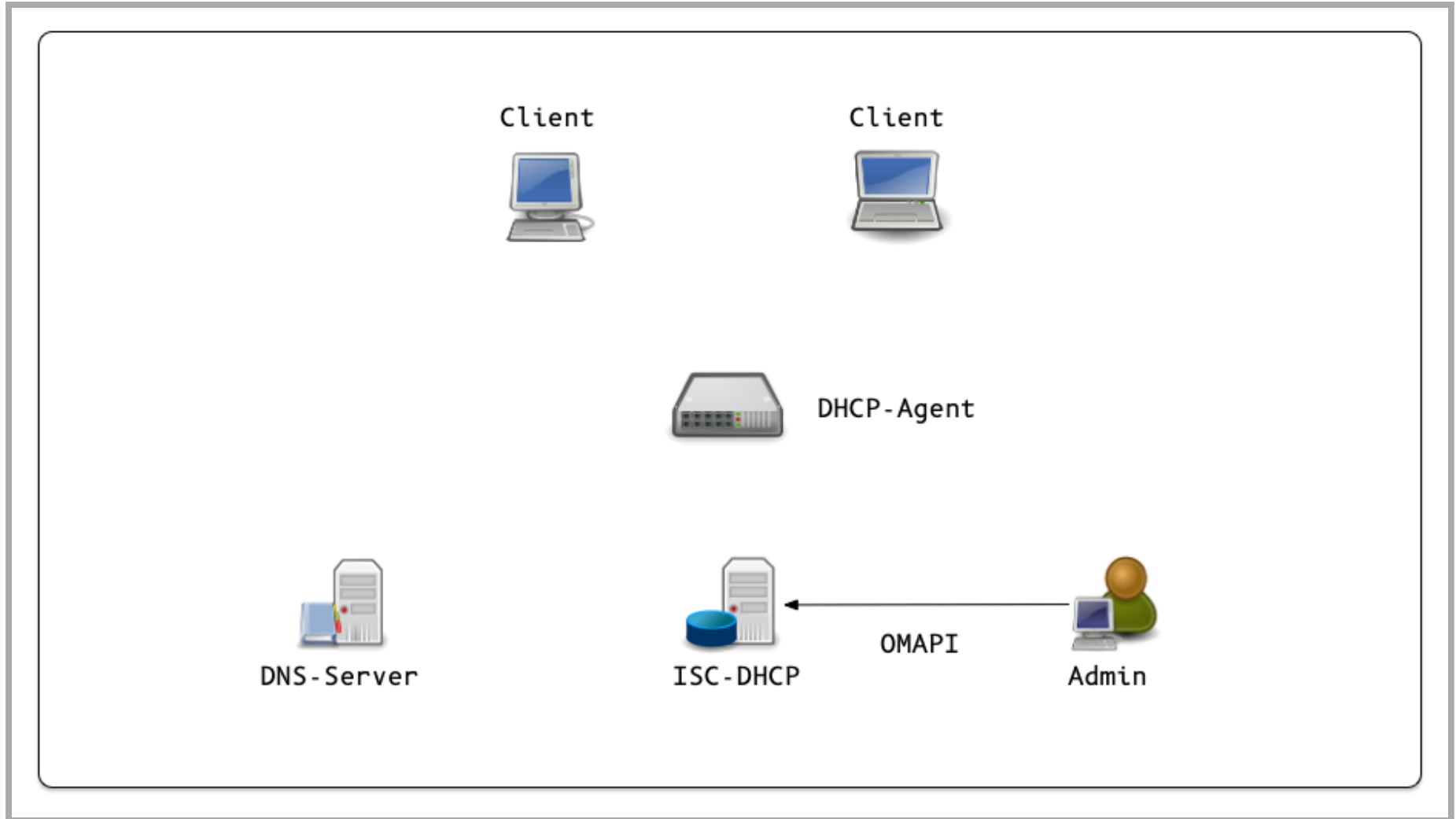


- Kea-DHCP and ISC-DHCP are different server implementations of the DHCP protocol
- Migrating from ISC-DHCP to Kea-DHCP very often requires changes in the way the DHCP service is being configured
- The next slides give an high-level overview of their functions

# ISC-DHCP Overview (1/4)

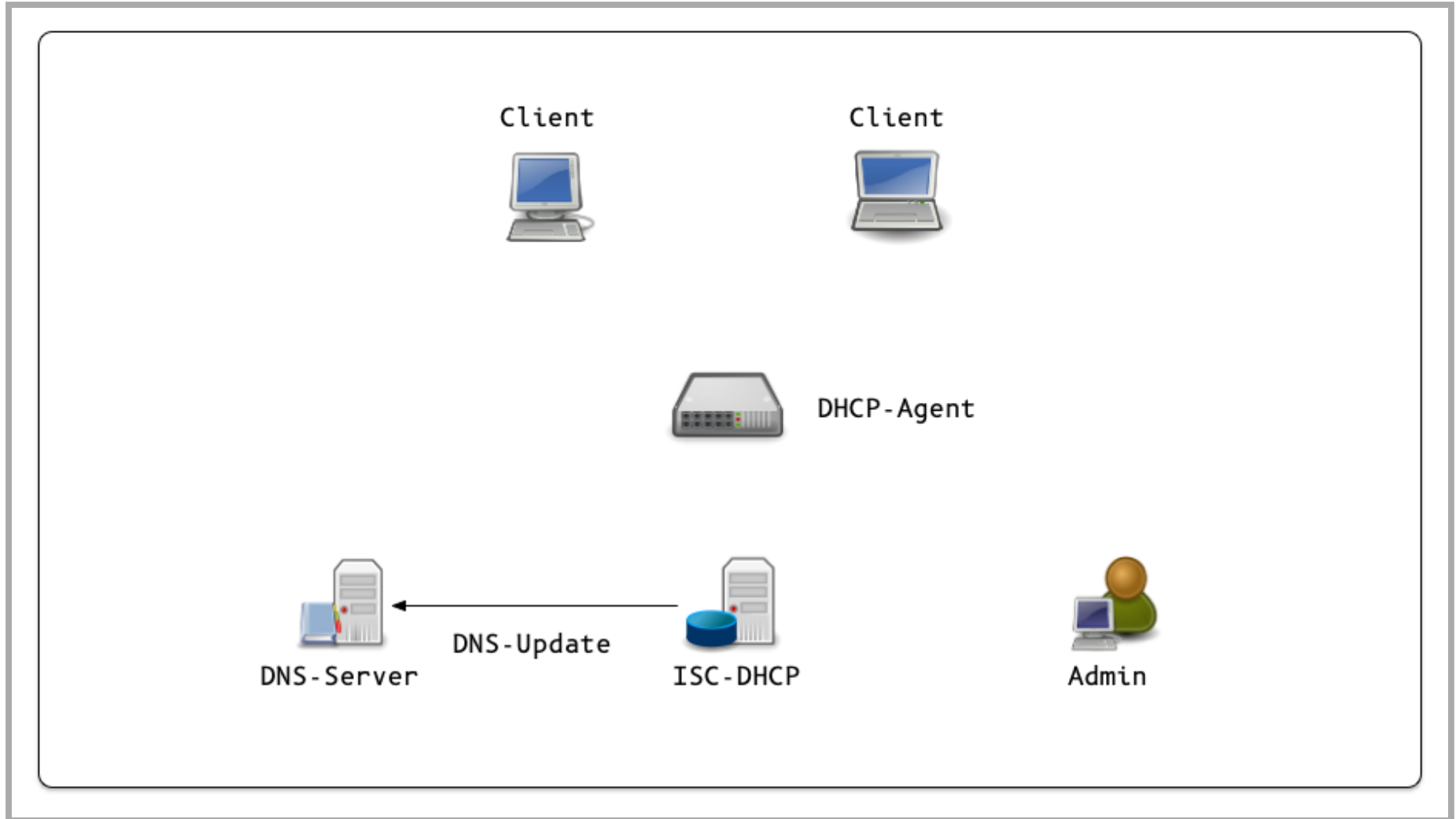


# ISC-DHCP Overview (2/4)

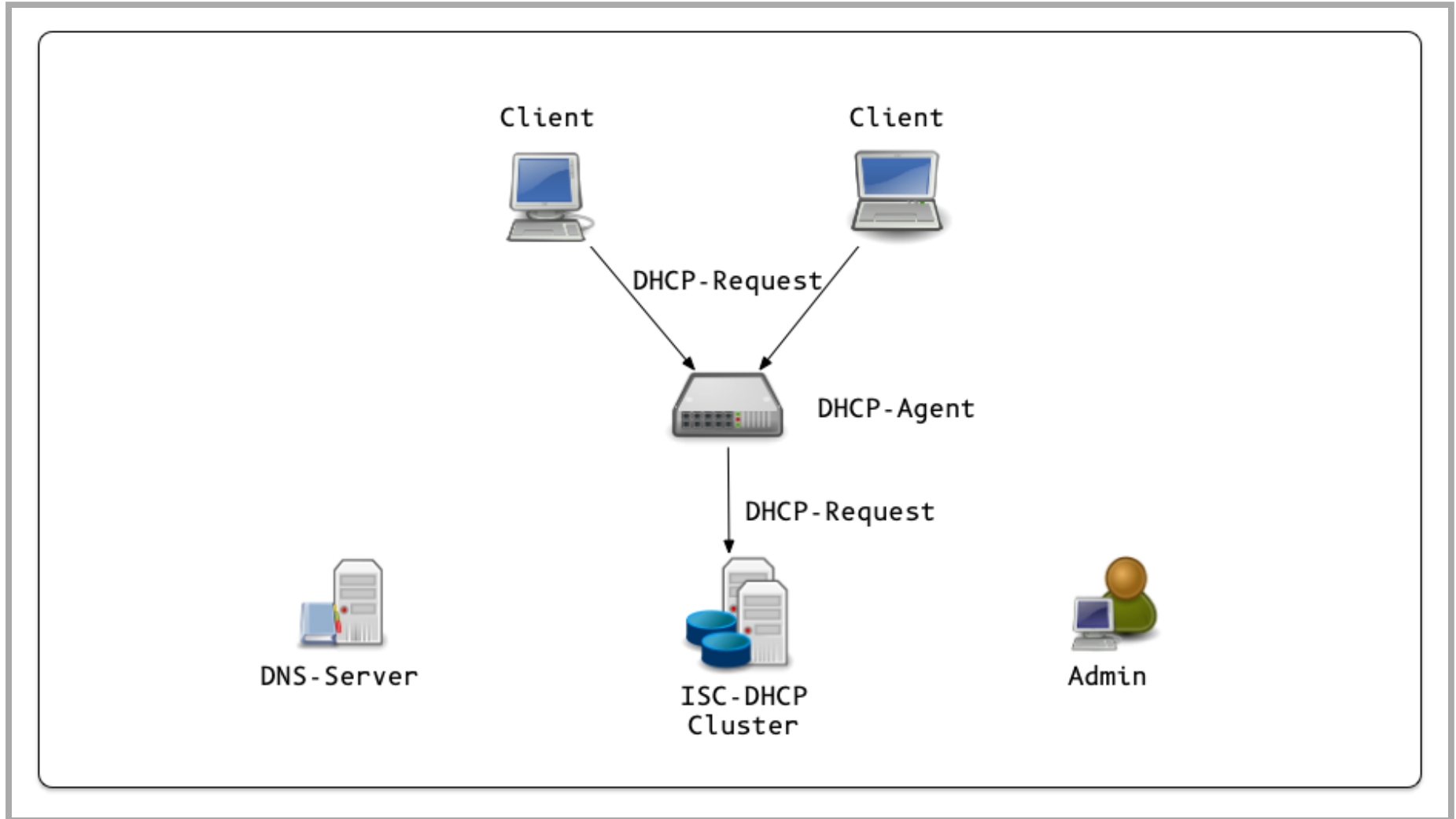




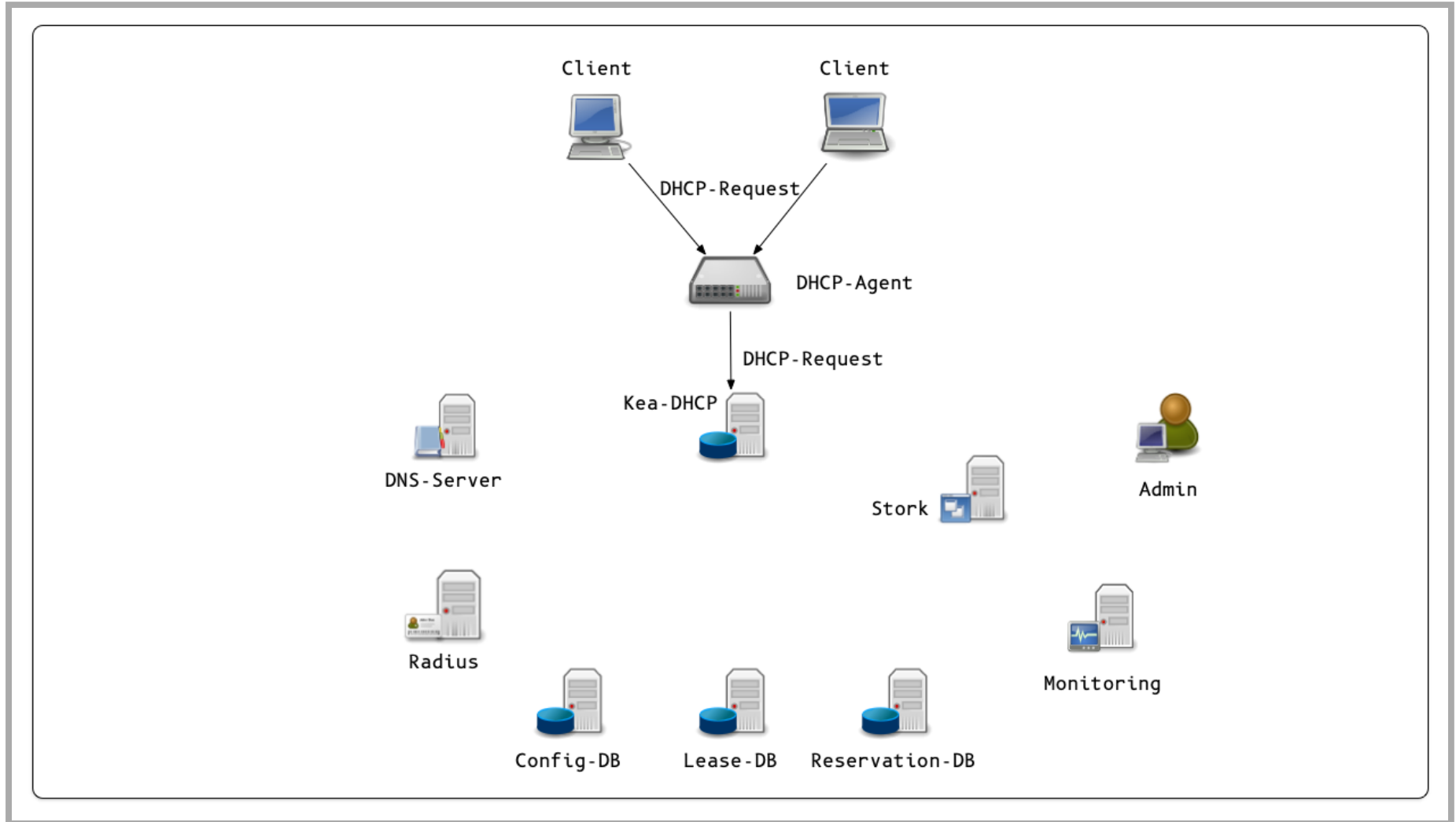
# ISC-DHCP Overview (3/4)



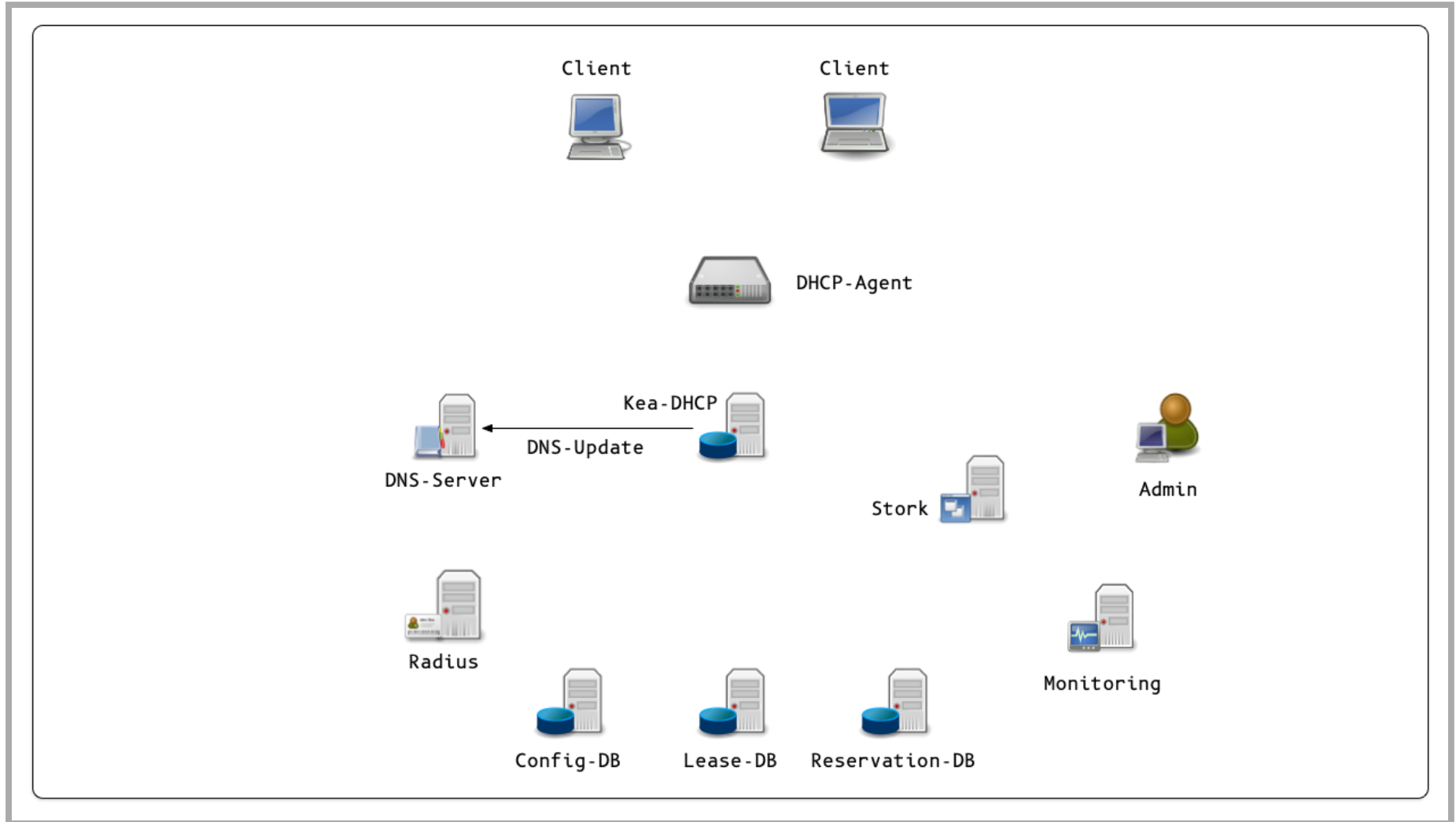
# ISC-DHCP Overview (4/4)



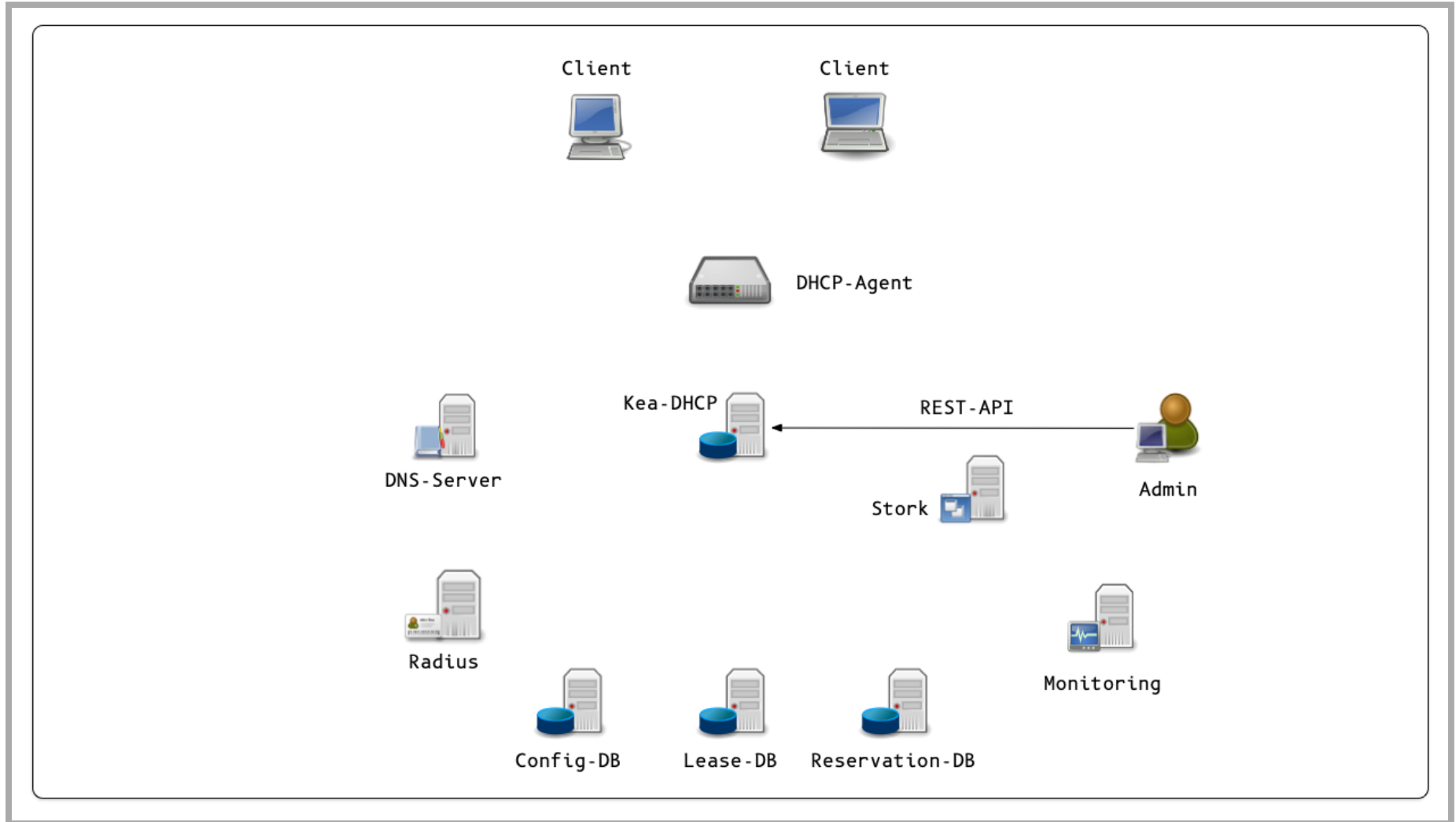
# Kea-DHCP Overview (1/10)



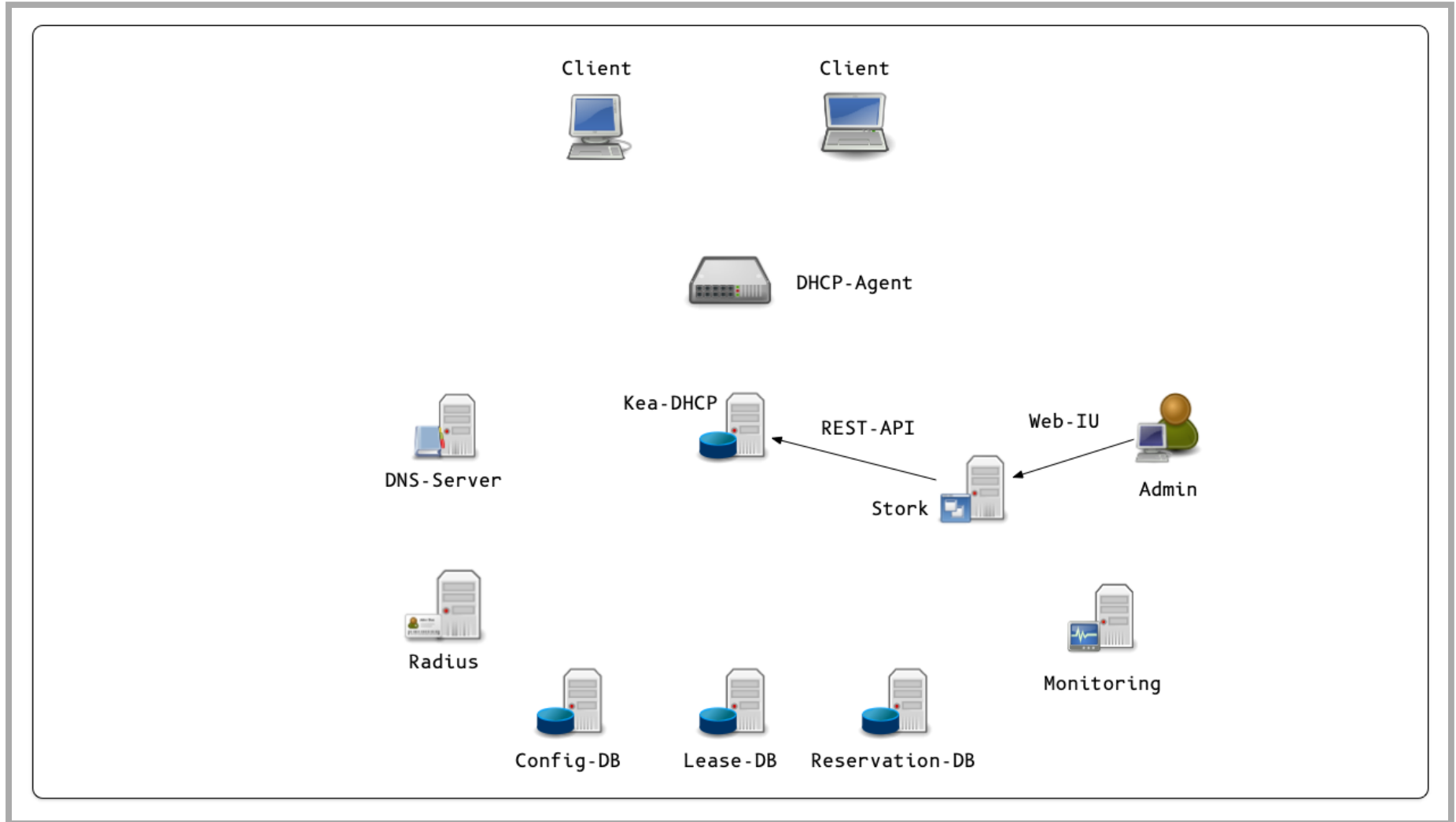
# Kea-DHCP Overview (2/10)



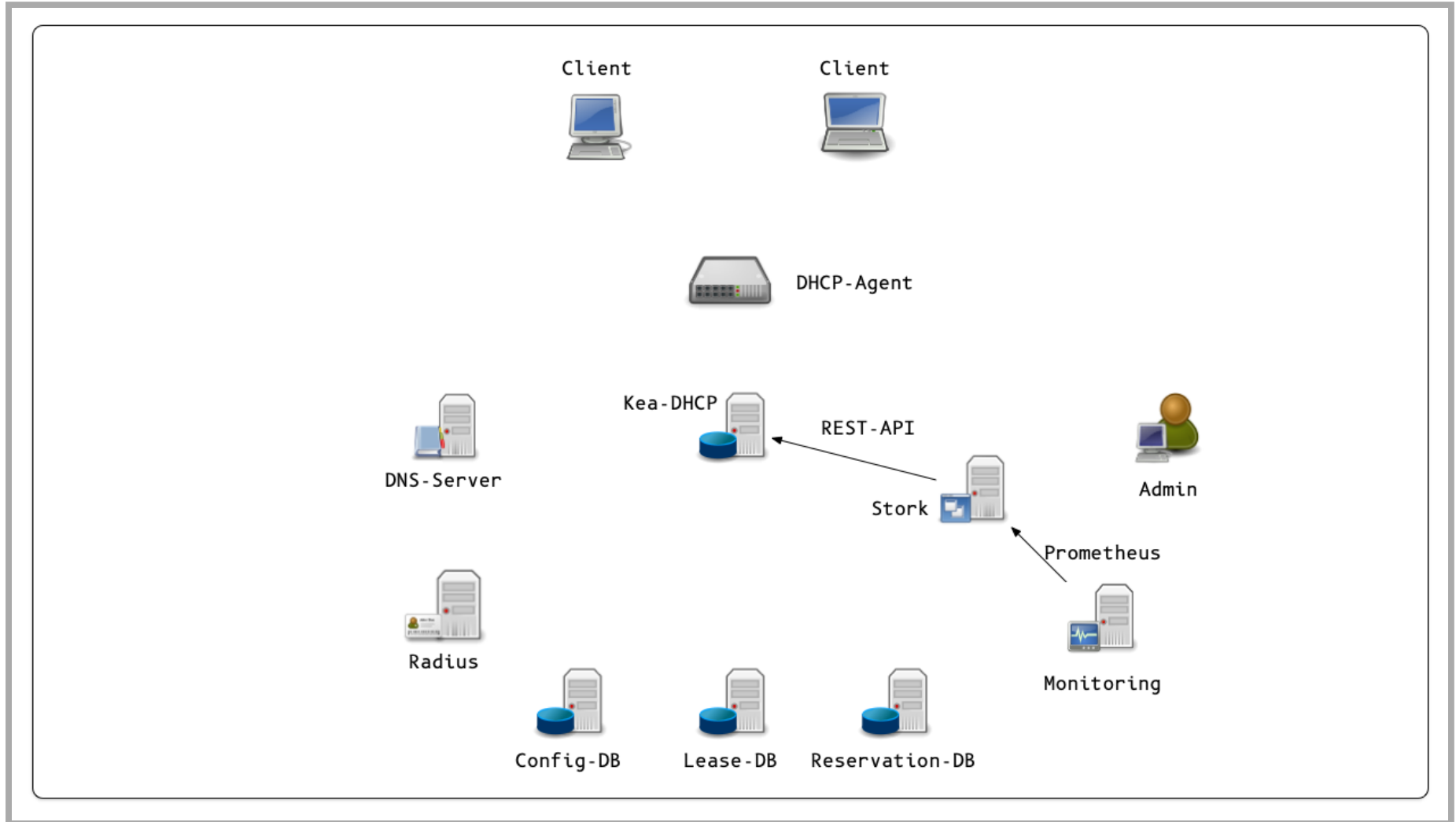
# Kea-DHCP Overview (3/10)



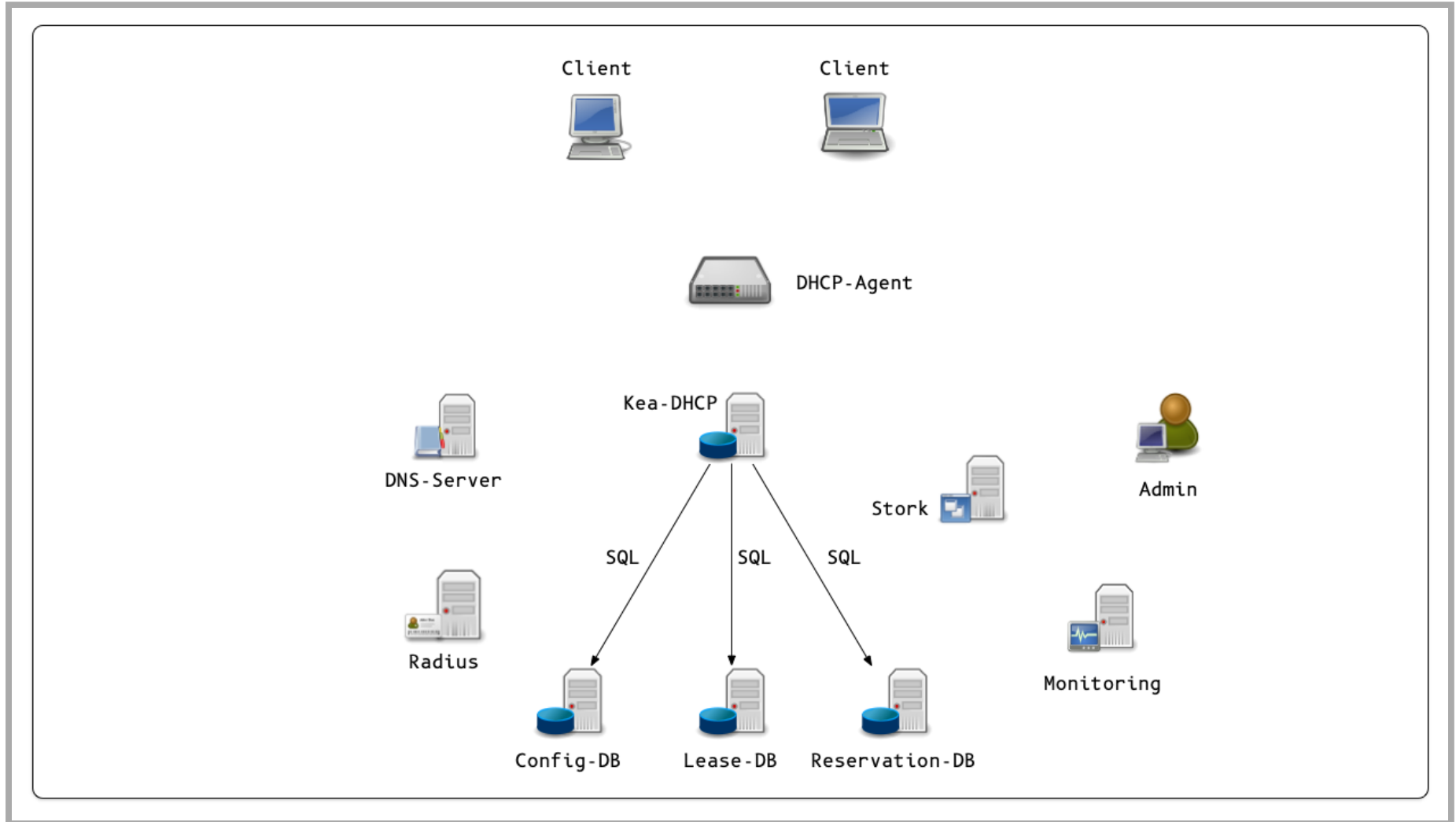
# Kea-DHCP Overview (4/10)



# Kea-DHCP Overview (5/10)

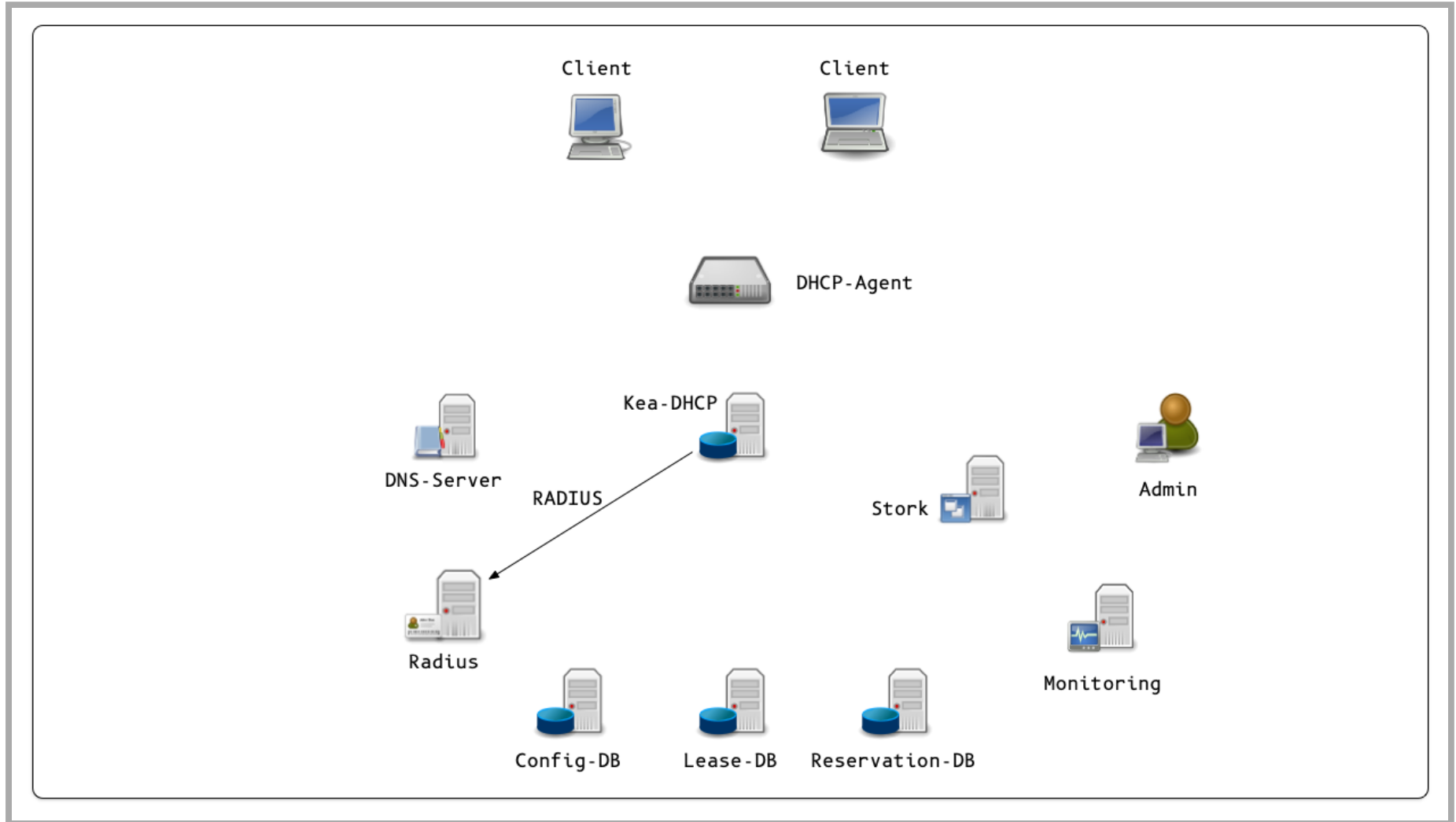


# Kea-DHCP Overview (6/10)

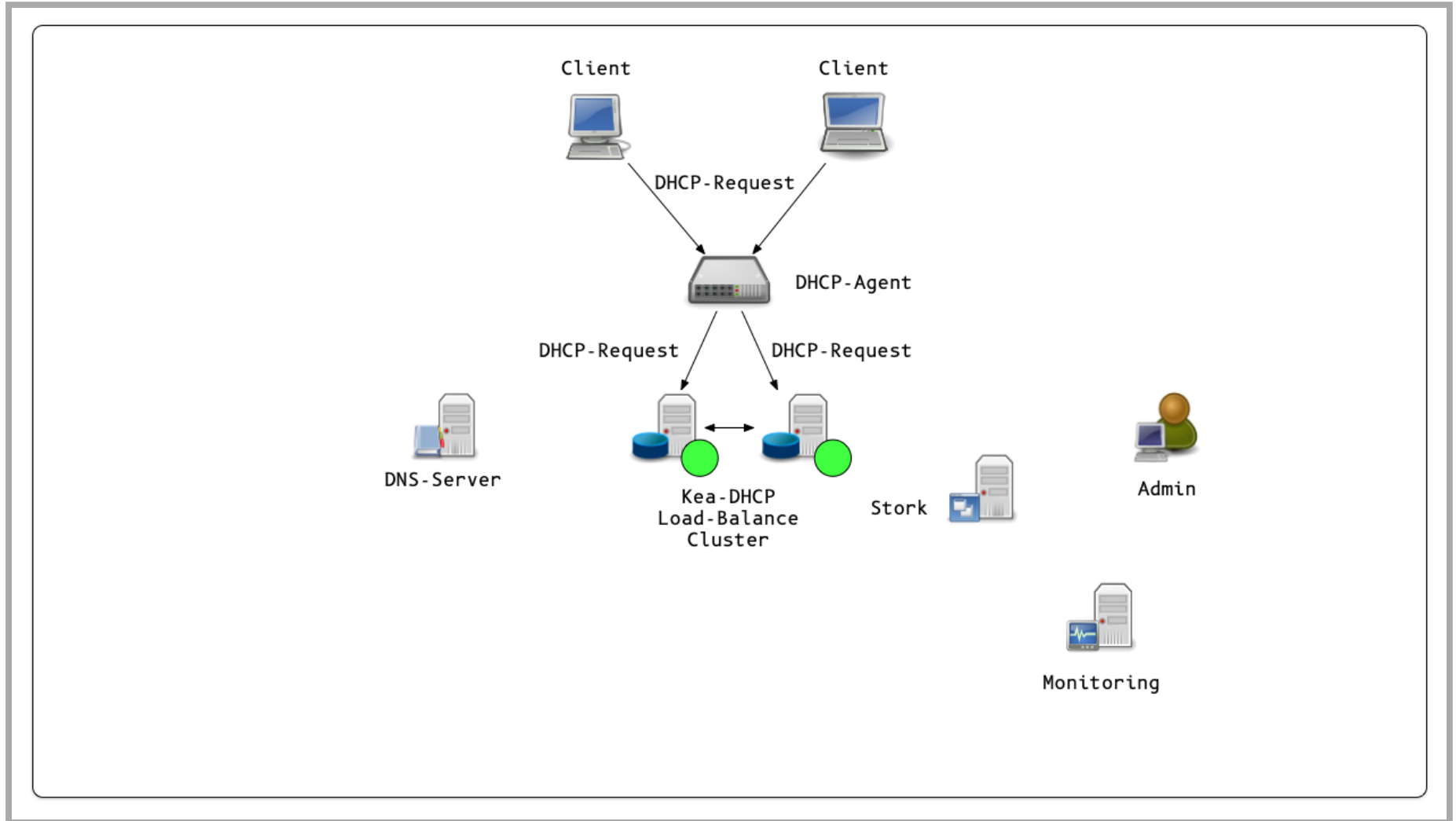




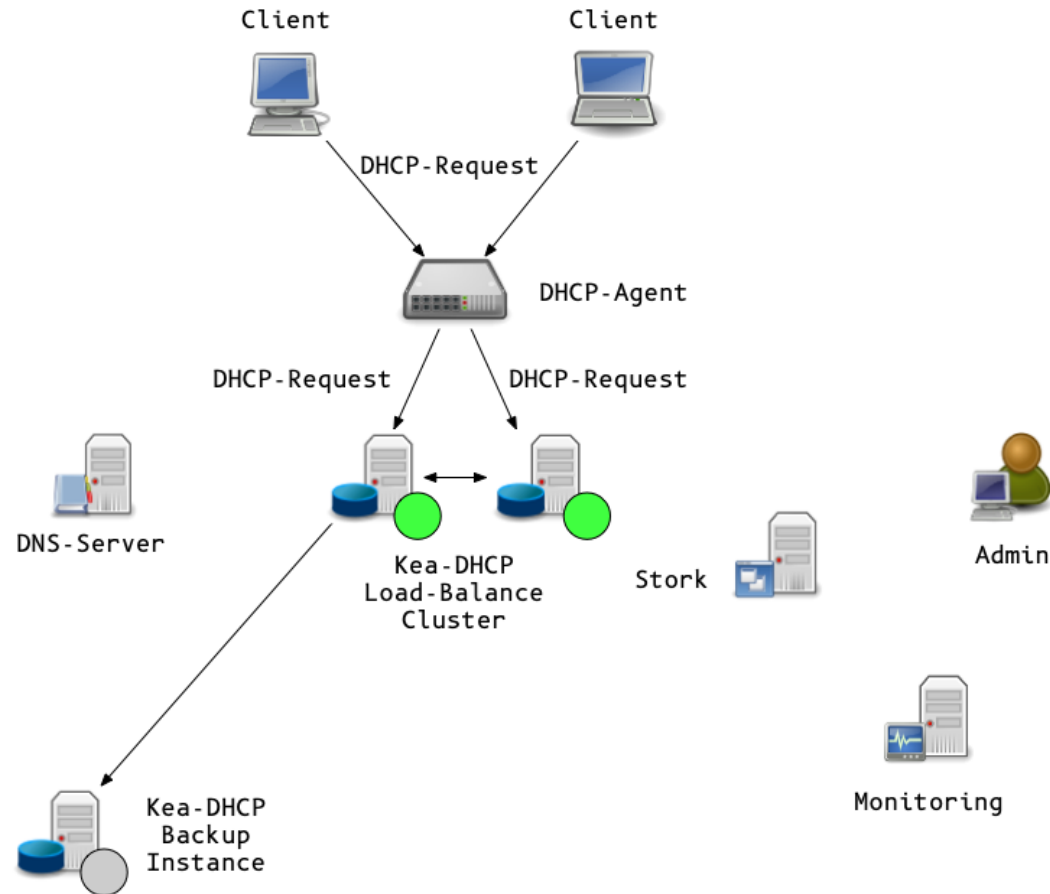
# Kea-DHCP Overview (7/10)



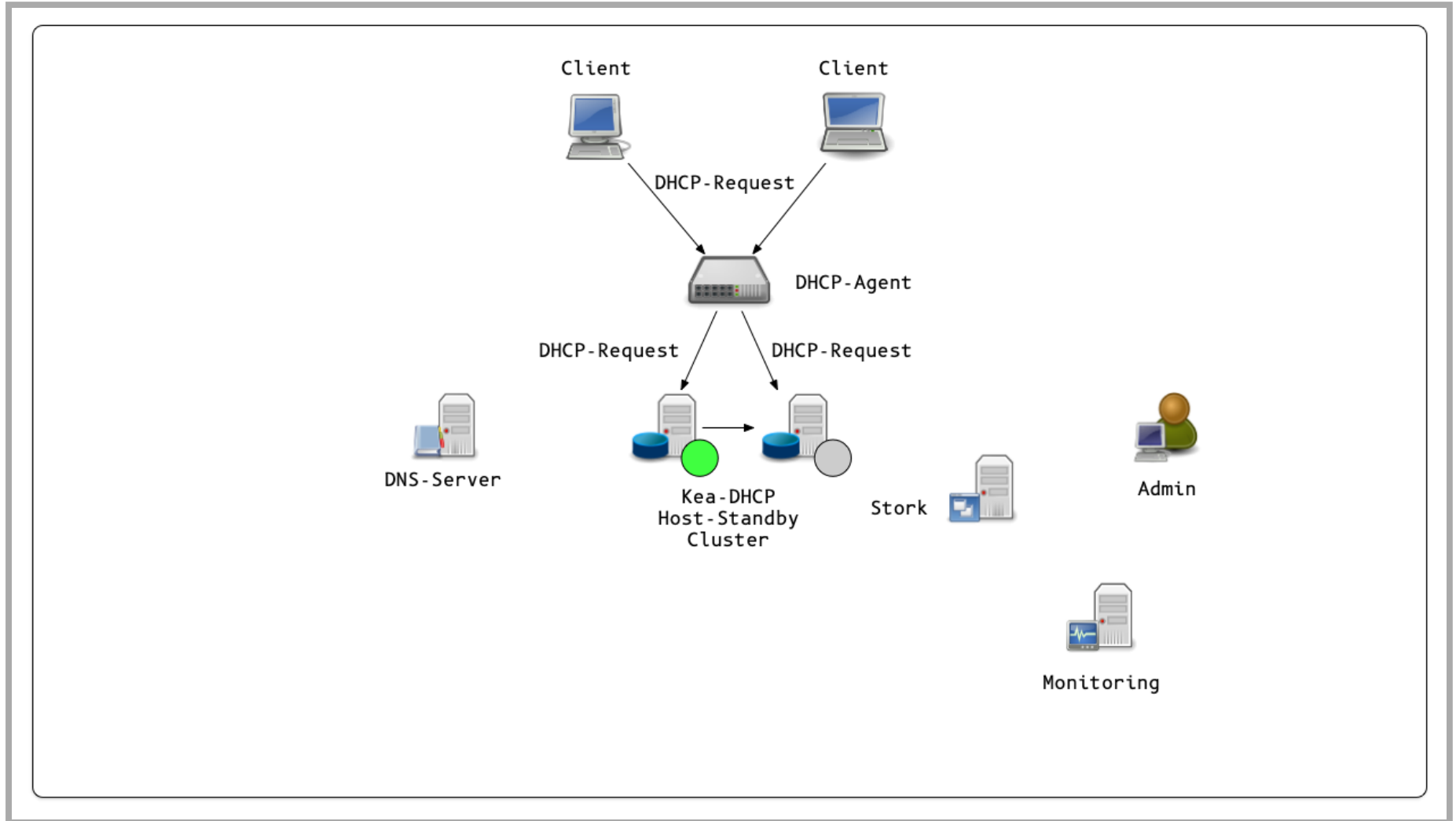
# Kea-DHCP Overview (8/10)



# Kea-DHCP Overview (9/10)



# Kea-DHCP Overview (10/10)



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# Documentation



- A key for a successful migration is a good understanding of the existing ISC-DHCP configuration
  - Often the details of the current DHCP implementation have been grown organically and the finer have been lost in time
- All documentation on the DHCP service and the network related services (DHCP agent configuration) should be updated (see next slide)



# Client-Classes, Options, Subnets, Shared-Networks, Reservations ...

- These are the configuration parts that should be documented
  - Subnets
  - Shared-Networks
  - Reservations (Global and per Subnet)
  - Client-Classes
  - DHCP Options (Global, per Subnet, per Reservation ...)
  - DHCP Base-Parameter (Lease-Time, Renew-Timer ...)
  - DHCP Relay-Agent configuration
  - DHCP Fail-Over/High-Availability

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# Special Processing in ISC-DHCP



- The configuration file format of ISC-DHCP is like a programming language
  - This allows a very flexible processing of DHCP requests, with conditional assignment of DHCP options or even re-writing parts of the DHCP packet
  - But it is slow and not multi-threaded
  - Kea-DHCP works differently (for performance reasons), the configuration format is different
    - most of the ISC-DHCP functionality can be implemented (using build-in Kea DHCP features or external hooks)

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## Testlab/Test-Network



- Experiences from migration projects show that having a test-lab with DHCP-Clients, DHCP-Relay-Agents and one or more Kea-DHCP Server (can be virtual machines) does help in preparation for a migration



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# Monitoring



- If no DHCP monitoring exists, it's a good idea to implement the monitoring before starting the migration and use the monitoring to help with the migration process
  - The "Resources" chapter later in this webinar contains links to ISC-DHCP and Kea-DHCP monitoring tools

# Feedback and communication to ISC



- ISC needs feedback from users to make the products better
  - This includes Kea-DHCP and the migration tools
- A Test-Lab/-Network can help to identify issues in an early stage of the migration
- Don't hesitate to get in contact
  - ISC Mailing lists: <https://lists.isc.org/mailman/listinfo>
  - Please post on dhcp-users about your migration experiences, good or bad. Other users will benefit, even if they don't have a 'question' to ask the list
  - ISC Gitlab - review existing tickets, roadmaps or open new issue tickets. Get direct feedback from the team at ISC: <https://gitlab.isc.org>

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# De-fragment the network

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# Clean up



- Switching the DHCP implementation is not a minor task
- Try to adjust the network to match modern requirements
  - De-Clutter the network assignments - remove Shared-Networks where possible
  - Free up unused IPv4 space where possible
  - IP Address Management (IPAM) systems can be a great help (open source like NetBox or closed source products)
  - Update the documentation on the way

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## Consider IPv6



- Instead of migrating a legacy IPv4 network, consider moving to IPv6 (in all or selected networks)
- Maybe some networks can run with automatic IP addressing (SLAAC), and DHCP is not needed everywhere

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## Make use of new functions in Kea-DHCP



- Make yourself familiar with the functions and features of Kea-DHCP (the recordings of the ISC Kea DHCP webinar series will help, also reading the Kea DHCP documentation: <https://kea.readthedocs.io> )
  - Some solutions that were difficult and complicated with ISC-DHCP might now be easy to implement

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**The choice to be made: Kea high availability**

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# "so many options, which should I implement?"

- Kea offers many different high-availability options
  - For an user new to Kea or DHCP administration, this can be a hard choice
- The next slides give some general recommendations and guidance on how to select an high-availability option for a Kea deployment



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## Load-balancing vs. hot-standby



- As the name implies, in the *load-balancing* mode the load is distributed across both active DHCP servers
  - With complex client classing rules, this can be faster than a single active server (still one server should have enough resources to be able to process all DHCP requests)
  - The *load-balancing* mode requires a (manual) 50/50 split of the pools across both HA server nodes - there is no rebalance in Kea-DHCP

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## Load-balancing vs. hot-standby



- The *hot-standby* mode is simpler
  - Only one active server, one active log file for trouble shooting
  - No split pools required
  - Easier for upgrading/updating the Kea-DHCP software
  - If in doubt, use *hot-standby*

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## HA Module vs. shared database



- A shared database setup offers redundancy for more than two active DHCP servers
- In a shared database setup, two clients might be offered the same IP address
  - One will succeed, the other will get a DHCPNAK from the server and has to start the DHCP process again.
- The HA module works with the *memfile* lease database, which offers better performance compared to an SQL database (and is simpler to setup and use)

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## HA Module vs. split/shared Pool



- Split- or shared pools only work well with DHCPv6
  - These are good options for IPv6-only networks
  - Split- or shared pools are simple and easy to maintain
- The HA module is more universal
  - It works for DHCPv4 and DHCPv6 and across all supported lease file storage back ends (*memfile* and SQL-Database)

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# Planning the migration

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## Roll-Back options



- Plan for regressions. No matter how much you test the new configuration, in an larger and complex network, there will be DHCP issues not anticipated
  - Some older, non-standard clients may have relied on special *fixups* in ISC DHCP that do not (yet) exist in Kea DHCP. Please let ISC know if you stumble upon such client systems still being used.
- With low lease times and configuration changes in the DHCP relay agents it is possible to switch back to the older DHCP service and investigate and solve the issue without pressure

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## Kea DHCP Hooks / Custom hooks



- Some special filtering or client-classing might be too complex or slow when implemented with the built-in Kea DHCP functions
  - In these cases, consider using a Kea DHCP hook library
  - You can create your own hooks, in C/C++, Python, Shell or other languages

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# Kea Migration Assistant (KeaMA)



- The Kea Migration Assistant is a great tool to get inspiration for the new Kea DHCP configuration
- Split the ISC-DHCP configuration into smaller, but complete single file configurations before applying KeaMA
  - Smaller configurations are easier to understand and reason about
- Test the resulting Kea-DHCP configuration in small but complete configurations
- Merge the migrated blocks into a larger configuration later



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# Step-by-Step migrations

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## Subnet by Subnet



- It is seldom possible (or recommended) to change the DHCP server in the whole network at once
- Often a DHCP run network can be migrated one subnet at a time
  - The configuration of the DHCP relay agents can be used to switch between old (ISC-DHCP) and new (Kea-DHCP)
  - Use low lease times to reduce the risk of duplicate IP Addresses

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## Lower-Risk networks



- Identify lower-risk networks to migrate first
  - Guest/Wifi Networks
  - Non-production networks
  - IPv6 networks (when introducing IPv6 alongside the DHCP migration)

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## Friendly knowledgeable users



- Look out for networks with friendly, knowledgeable users
  - Users with IT knowledge that can help troubleshoot DHCP issues
  - Opt-in Networks with new DHCP configs (WLAN)
  - IT Department networks

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## Migrating leases



- Reducing the lease time before migrating a subnet
  - Once the subnet is stable without issues on Kea-DHCP, increment the lease time back to the original level
- A new tool from ISC (keama-leases <https://gitlab.isc.org/isc-projects/keama-leases>) can move active leases from ISC-DHCP to Kea-DHCP

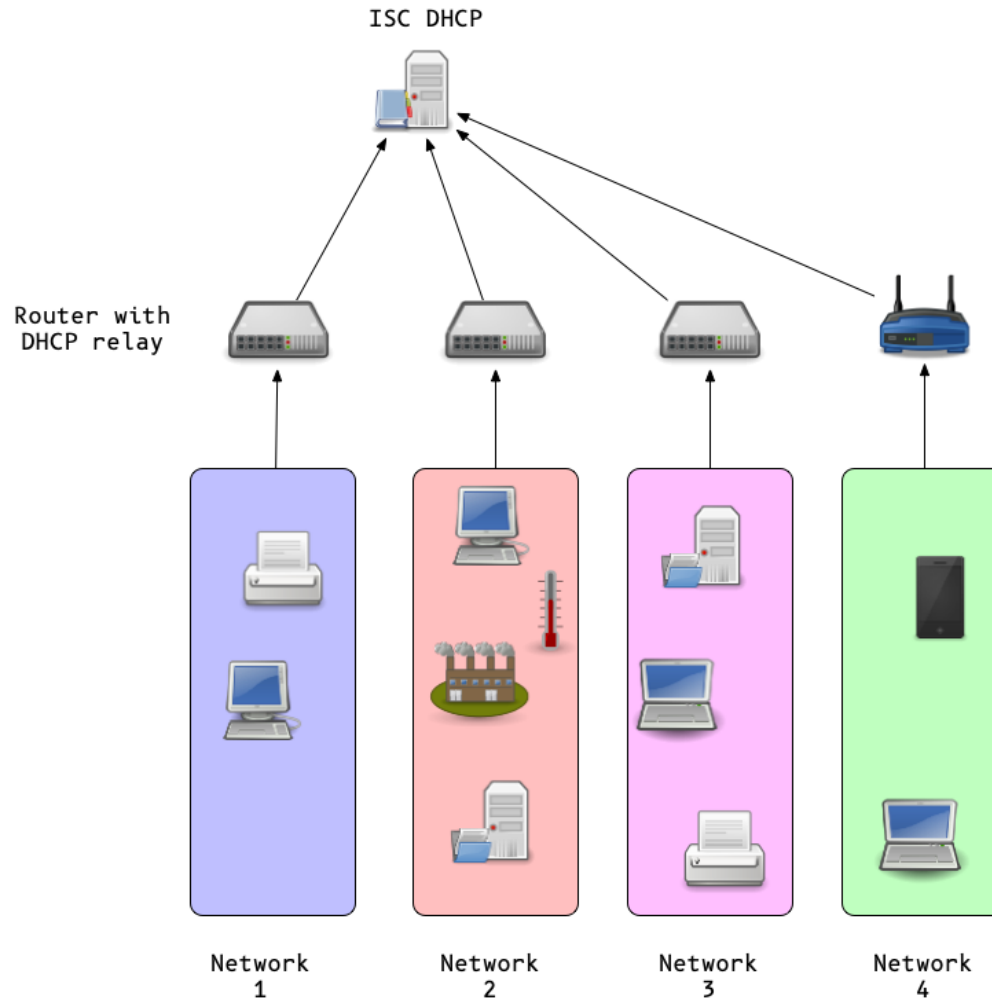
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# From ISC DHCP to Kea DHCP

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# Proposed migration steps



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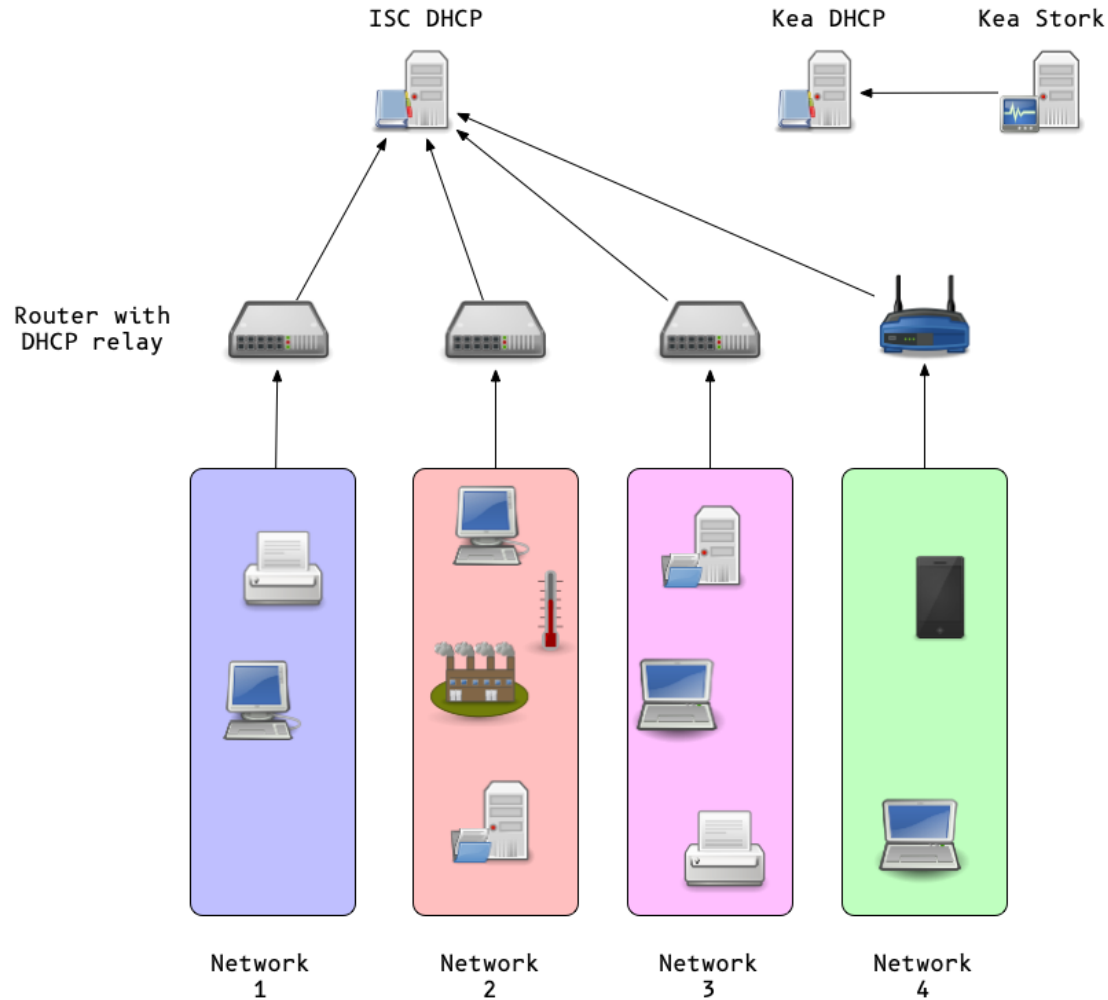
## Proposed migration steps



- 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



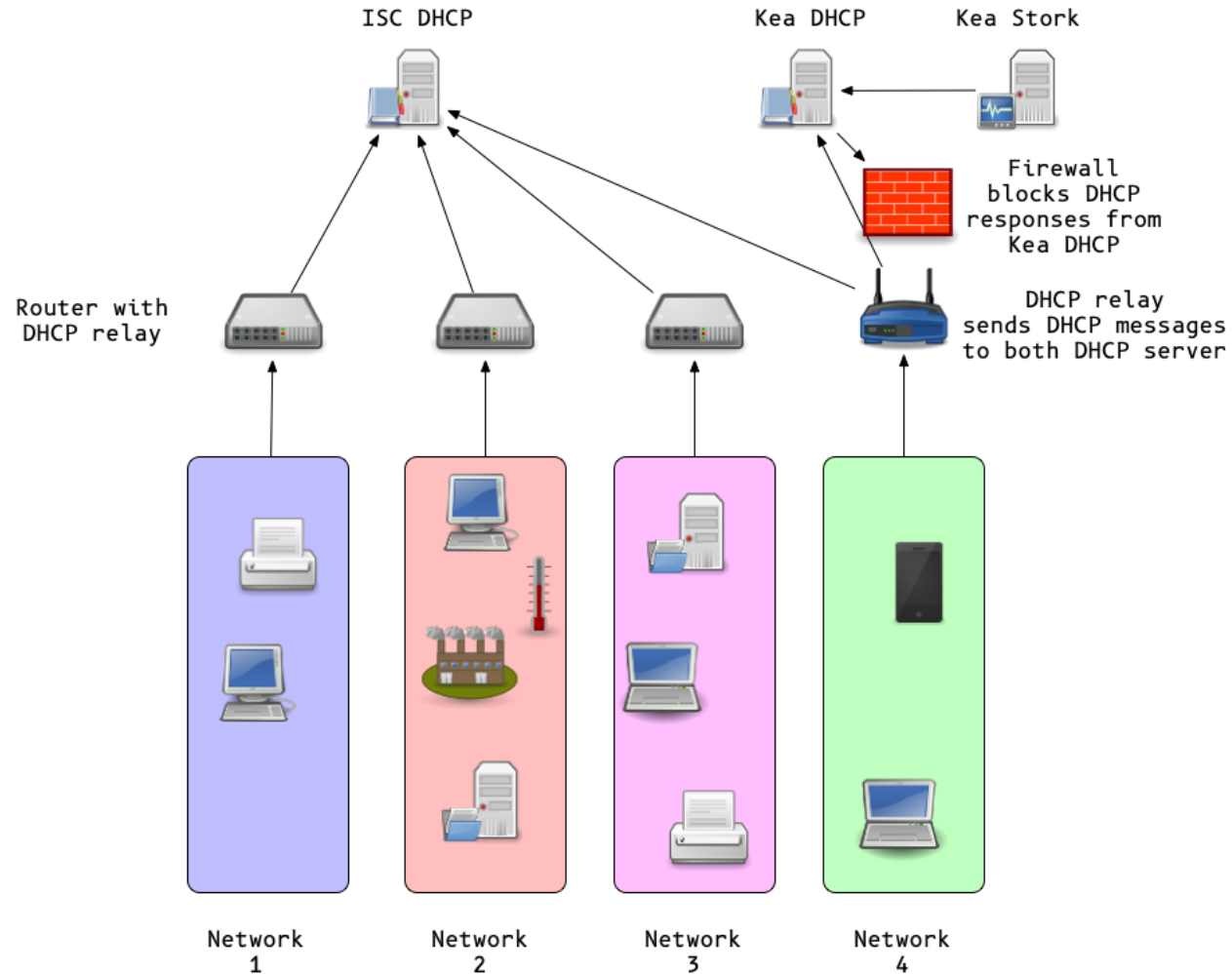
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## Proposed migration steps



- 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 - Kea DHCP must be in "udp" socket mode for this to work)
    - Inspect the responses from Kea DHCP and compare with the responses from ISC DHCP
- Implement Logging and Monitoring

# Proposed migration steps



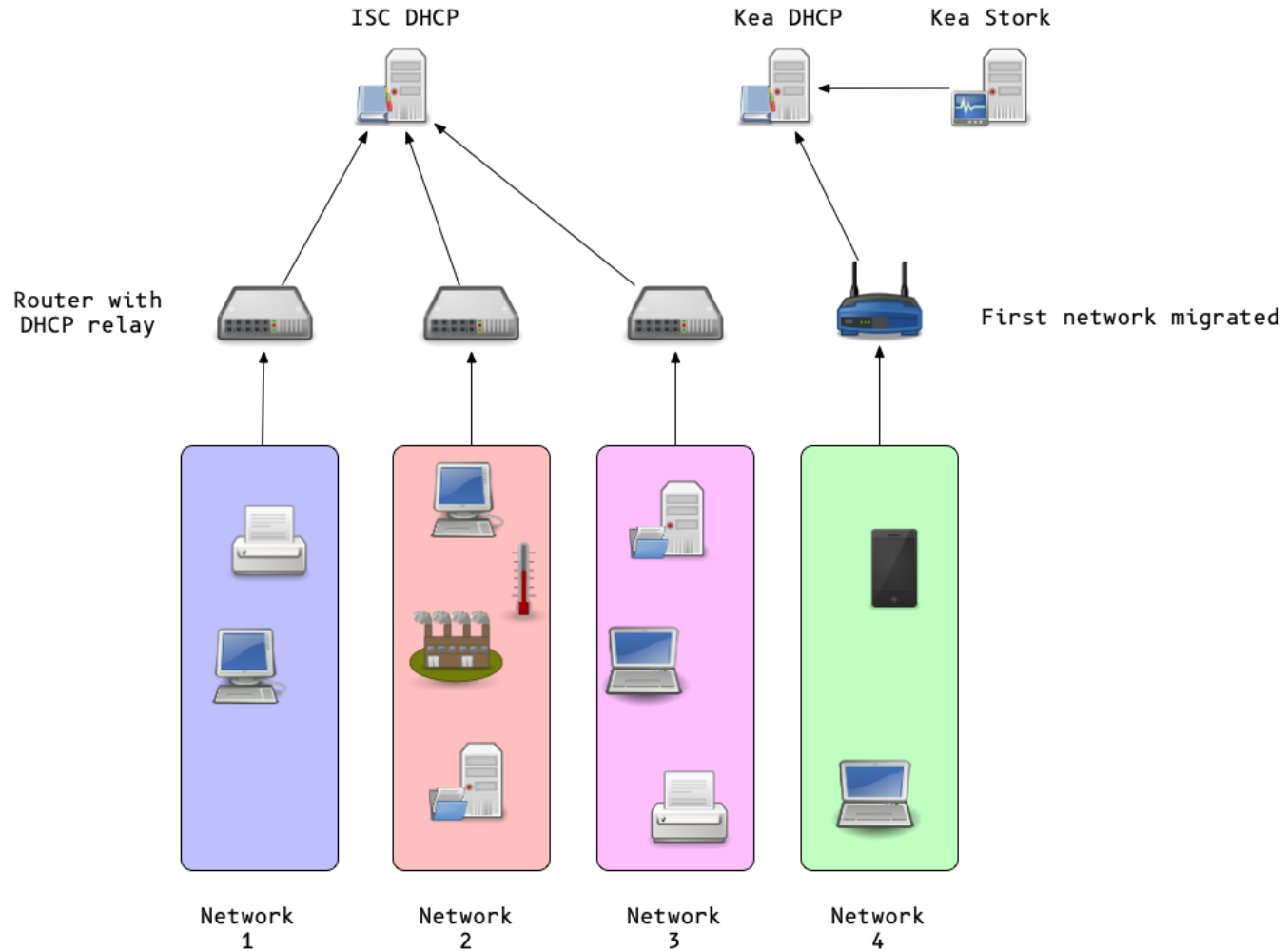
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## Proposed migration steps



- 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



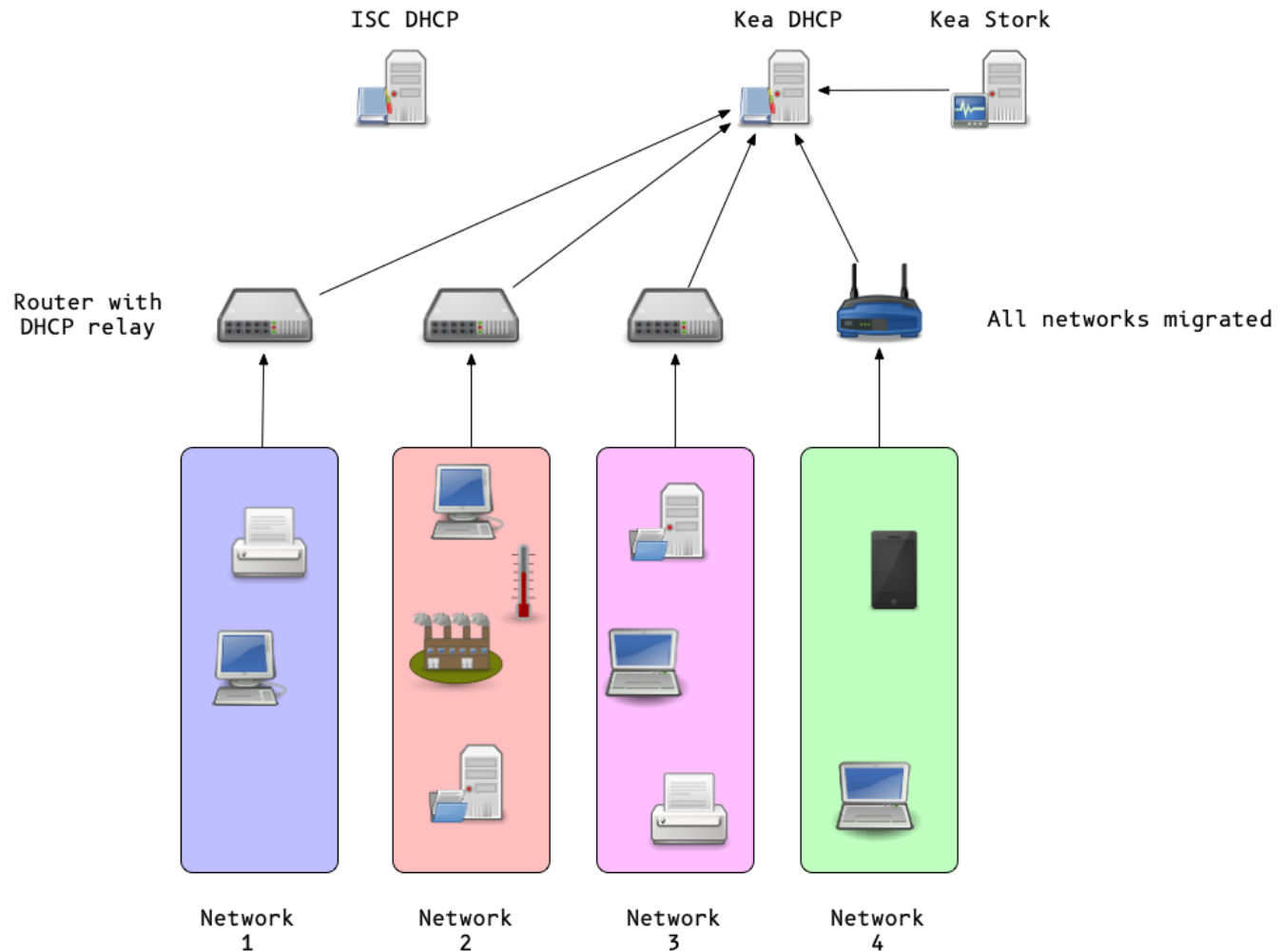
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## Proposed migration steps



- 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



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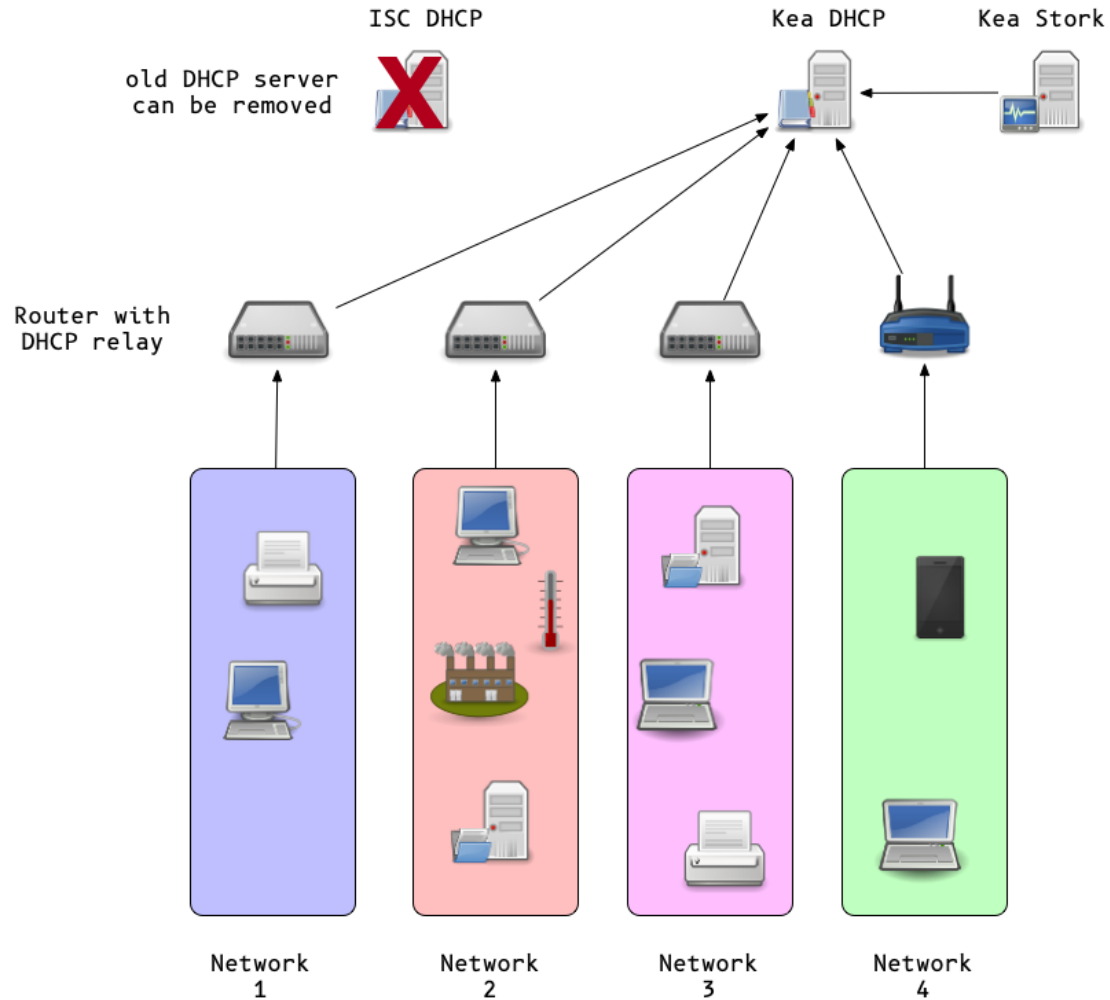
## Proposed migration steps



- 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



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# Resources

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## ISC - Migrating to Kea from ISC DHCP



- A collection of resources for System Administrators  
[https://www.isc.org/dhcp\\_migration/](https://www.isc.org/dhcp_migration/)

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# Migration Tools



- Kea Migration Assistant (KeaMA)
  - <https://kb.isc.org/docs/migrating-from-isc-dhcp-to-kea-dhcp-using-the-migration-assistant>
  - <https://gitlab.isc.org/isc-projects/dhcp/-/wikis/kea-migration-assistant>
- keama-leases <https://gitlab.isc.org/isc-projects/keama-leases>

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## Monitoring Tools for ISC-DHCP



- DHCP-Pools: ISC dhcpd lease analysis and reporting  
<https://dhcpd-pools.sourceforge.net/>
- Prometheus exporter for DHCP stats, uses dhcpd-pools  
<https://github.com/atonkyra/dhcp-stats-prometheus>
- A rust prometheus exporter for dhcpd\_pools  
[https://github.com/mindflavor/prometheus\\_dhcp\\_exporter](https://github.com/mindflavor/prometheus_dhcp_exporter)

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## Monitoring Tools for ISC-DHCP



- ISC DHCP Tools collection: <https://www.isc.org/dhcp-tools/>
- A Prometheus exporter for the ISC dhcpd daemon's dhcpd.leases file  
[https://github.com/DRuggeri/dhcpd\\_leases\\_exporter](https://github.com/DRuggeri/dhcpd_leases_exporter)
- Extension for monitoring the ISC DHCP server with SNMP <https://github.com/ohitz/dhcpd-snmp>

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# Monitoring Tools for Kea-DHCP



- Monitoring Kea With Stork  
<https://kea.readthedocs.io/en/kea-2.2.0/arm/stork.html>
- Export Kea Metrics in the Prometheus Exposition Format <https://github.com/mweinelt/kea-exporter>

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# Upcoming ISC Webinar

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- 07 Jun - Using the new dynamic templates in Kea



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# Questions / Answers

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