

# Stork

(Managing and Monitoring Kea DHCP)

**Carsten Strotmann and the ISC Team**

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# Welcome

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Welcome to our Webinar on Stork and Kea DHCP



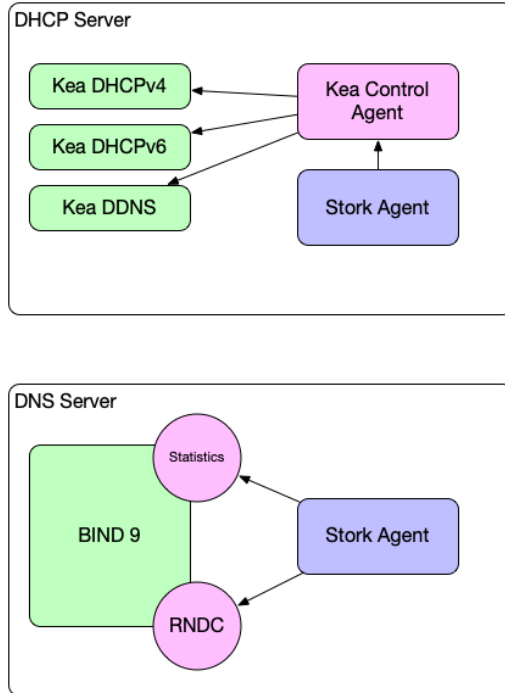
# In this Webinar

- What is Stork?
- New Features of Stork
- A Demo
- Stork Installation and Configuration
- Monitoring with Prometheus and Grafana
- Managing DHCP Reservations
- Hands-On Stork

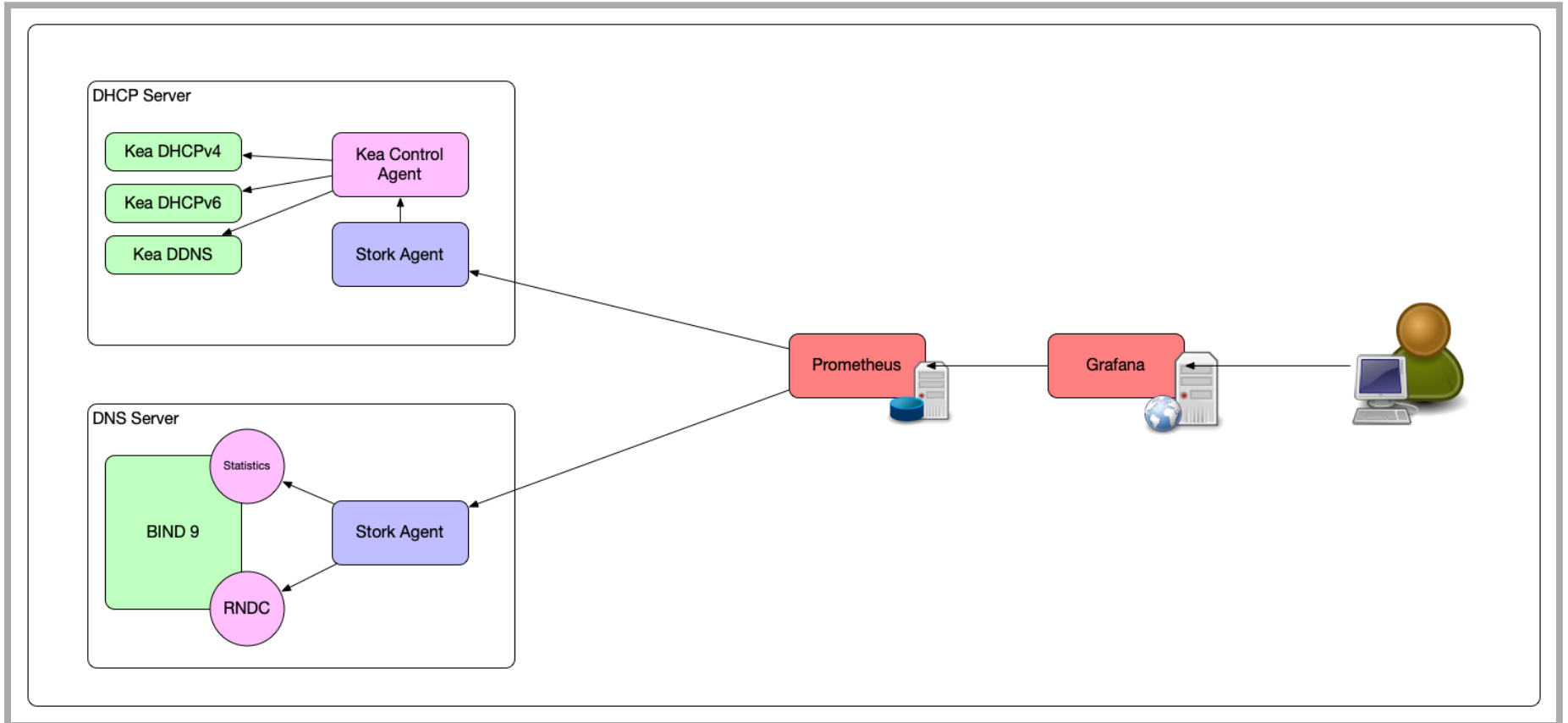
# What is Stork?

- Stork is an open source Monitoring and Management System for Kea DHCP and BIND 9
  - Web-UI
  - REST-API
  - Prometheus Exporter for Kea DHCP and BIND 9 (<https://prometheus.io>)
  - Integration into Grafana visualization (<https://grafana.com/grafana/>)

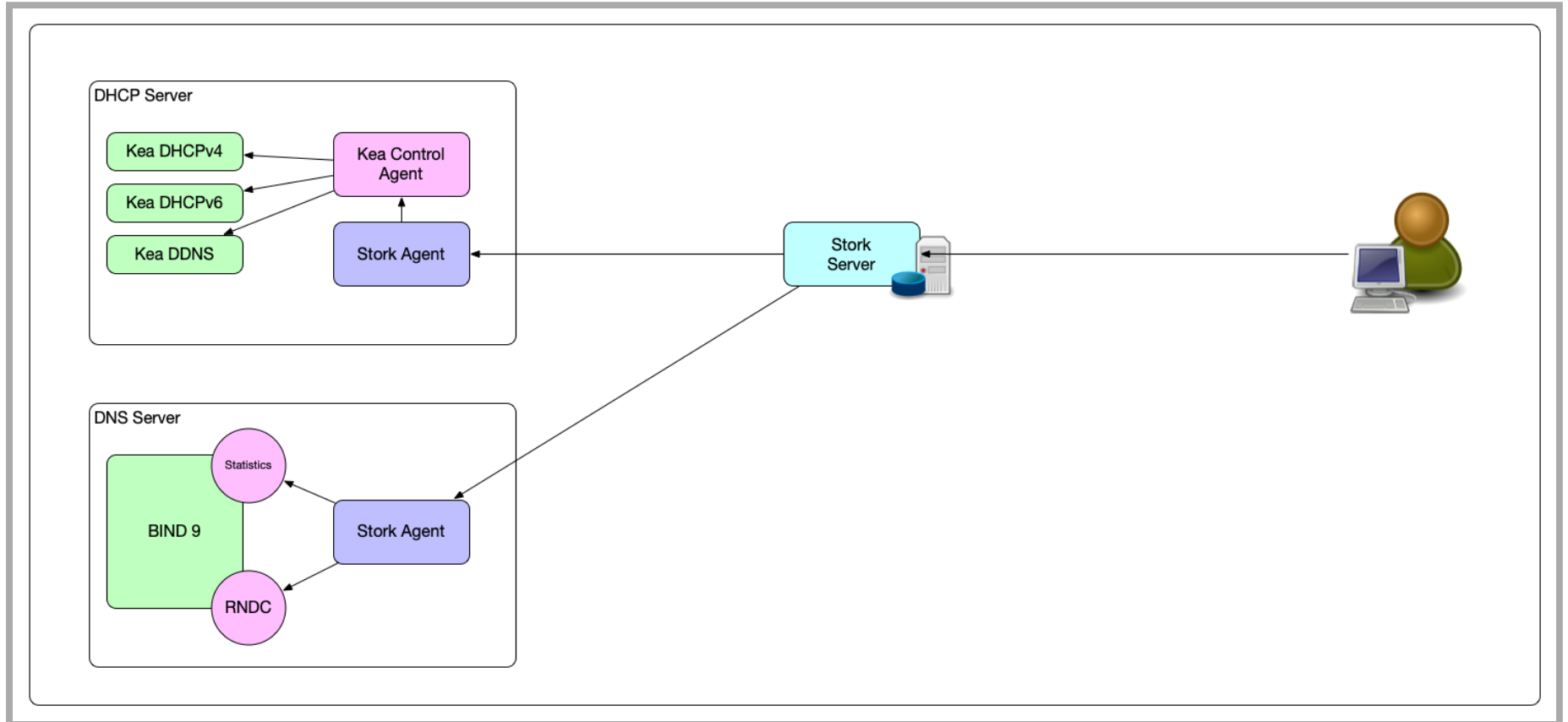
# Stork Architecture



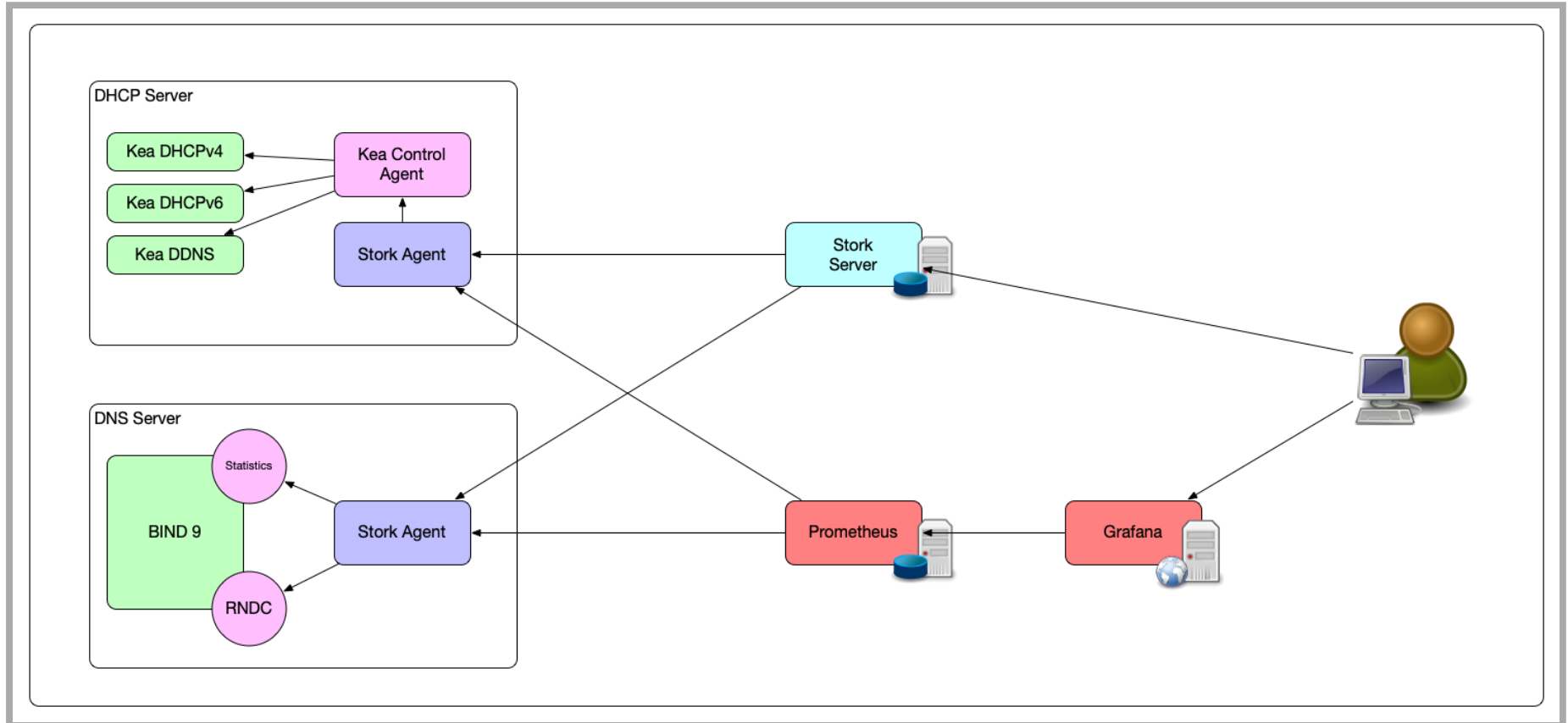
# Grafana Monitoring Only Setup



# Stork Monitoring and Management



# Stork and Grafana Monitoring (and Management)





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# Update on 2020 Stork Video


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## What's new


- This webinar does not cover all Stork functions in full detail
- See the video from 2020 for additional information on Stork (<https://www.youtube.com/watch?v=5aF9NBiKhqQ>)

# New: Reservation management

 DHCP ▾ Services ▾ Monitoring ▾ Configuration ▾ Help ▾  [\[→ Logout \(admin\)\] ▾](#)

[Home](#) > [DHCP](#) > [Host Reservations](#) 

[Host Reservations](#)



[+ New Host](#) [Refresh List](#)

DHCP Identifiers	IP Addresses	IPv6 Prefixes	Hostname	Global/Subnet	App Name
hw-address=(00:23:8b:f2:b8:13)	<a href="#">172.22.1.88</a>		lemote	172.22.1.0/24	<a href="#">kea@172.22.1.8</a> <a href="#">config</a>
hw-address=(00:26:b0:d6:a4:e0)	<a href="#">172.22.1.27</a>		macbookpro	172.22.1.0/24	<a href="#">kea@172.22.1.8</a> <a href="#">config</a>
hw-address=(00:30:48:d5:2a:b1)	<a href="#">172.22.1.11</a>		csos2-2	172.22.1.0/24	<a href="#">kea@172.22.1.8</a> <a href="#">config</a>
hw-address=(00:30:65:6f:f7:5a)	<a href="#">172.22.1.20</a>		imac	172.22.1.0/24	<a href="#">kea@172.22.1.8</a> <a href="#">config</a>
hw-address=(00:40:ca:dd:f2:80)	<a href="#">172.22.1.32</a>		amilopro	172.22.1.0/24	<a href="#">kea@172.22.1.8</a> <a href="#">config</a>
hw-address=(00:50:da:42:91:c7)	<a href="#">172.22.1.75</a>		cyrix686	172.22.1.0/24	<a href="#">kea@172.22.1.8</a> <a href="#">config</a>
hw-address=(00:d0:b7:ad:3d:3c)	<a href="#">172.22.1.24</a>		csmobile	172.22.1.0/24	<a href="#">kea@172.22.1.8</a> <a href="#">config</a>
hw-address=(00:e0:7d:a3:2e:e7)	<a href="#">172.22.1.4</a>		nfssrv	172.22.1.0/24	<a href="#">kea@172.22.1.8</a> <a href="#">config</a>
hw-address=(08:00:09:1e:72:da)	<a href="#">172.22.1.76</a>		hp715-80	172.22.1.0/24	<a href="#">kea@172.22.1.8</a> <a href="#">config</a>
hw-address=(10:9a:dd:4f:0b:da)	<a href="#">172.22.1.21</a>		macmini2	172.22.1.0/24	<a href="#">kea@172.22.1.8</a> <a href="#">config</a>

3 of 4 pages << < 1 2 **3** 4 > >>  ▾

# New: Global Search / Leases Search

The screenshot shows a web interface for DHCP management. At the top, there is a navigation bar with tabs: DHCP, Services, Monitoring, Configuration, and Help. A search bar in the top right contains the text '172.22.' and a button to 'Logout (admin)'. Below the navigation bar, the main content area is titled 'Host Rese' (likely 'Host Reservations'). It features a table with four columns: Subnets, Hosts, Machines, and Apps. The 'Subnets' column shows '[3] 172.22.1.0/24' with a 'more' link. The 'Hosts' column shows a list of four entries with their hardware addresses and a 'more' link. The 'Machines' column shows '[3] home01' with a 'more' link. The 'Apps' column shows 'kea@172.22.1.8' and 'home01-DNS-Resolver'. To the right of the table, there is a 'Refresh List' button. At the bottom, there is a pagination bar showing '3 of 1 pages' and a dropdown menu set to '10'.

Subnets	Hosts	Machines	Apps
[3] 172.22.1.0/24 <a href="#">more</a>	[40] hw-address=00:02:b3:d3:7f:f4 [41] hw-address=00:03:ba:15:08:19 [42] hw-address=00:03:ba:f2:e9:f1 [43] hw-address=00:04:13:25:5e:23 [44] hw-address=00:04:13:75:2d:af <a href="#">more</a>	[3] home01 <a href="#">more</a>	kea@172.22.1.8 home01-DNS-Resolver

3 of 1 pages << < 1 > >> 10

# New: View Logs

## Loggers

Logger	Severity	Output Location
kea-dhcp4	info	stdout
kea-dhcp4	info	<a href="#">/var/log/kea/kea-dhcp4.log</a>

Stork DHCP Services Monitoring Configuration Help Search (+) Logout (admin)

← Back to Kea view

+ - ↺ Log /var/log/kea/kea-dhcp4.log from the app kea@172.22.1.8 on the machine [3] 172.22.1.8

```
...
2023-02-20 11:23:59.720 INFO [kea-dhcp4.commands/1520.140217139232064] COMMAND_RECEIVED Received command 'config-get'
2023-02-20 11:24:21.569 INFO [kea-dhcp4.commands/1520.140217139232064] COMMAND_RECEIVED Received command 'statistic-get-all'
2023-02-20 11:24:21.586 INFO [kea-dhcp4.commands/1520.140217139232064] COMMAND_RECEIVED Received command 'subnet4-list'
2023-02-20 11:24:29.831 INFO [kea-dhcp4.commands/1520.140217139232064] COMMAND_RECEIVED Received command 'version-get'
2023-02-20 11:24:29.837 INFO [kea-dhcp4.commands/1520.140217139232064] COMMAND_RECEIVED Received command 'status-get'
2023-02-20 11:24:29.840 INFO [kea-dhcp4.commands/1520.140217139232064] COMMAND_RECEIVED Received command 'config-get'
2023-02-20 11:24:51.560 INFO [kea-dhcp4.commands/1520.140217139232064] COMMAND_RECEIVED Received command 'statistic-get-all'
2023-02-20 11:24:51.579 INFO [kea-dhcp4.commands/1520.140217139232064] COMMAND_RECEIVED Received command 'subnet4-list'
2023-02-20 11:24:52.079 INFO [kea-dhcp4.commands/1520.140217139232064] COMMAND_RECEIVED Received command 'stat-lease4-get'
2023-02-20 11:24:52.080 INFO [kea-dhcp4.stat-cmds-hooks/1520.140217139232064] STAT_CMDS_LEASE4_GET stat-lease4-get command successful,
parameters: [all subnets] rows found: 1
2023-02-20 11:24:52.083 INFO [kea-dhcp4.commands/1520.140217139232064] COMMAND_RECEIVED Received command 'statistic-get'
2023-02-20 11:24:59.970 INFO [kea-dhcp4.commands/1520.140217139232064] COMMAND_RECEIVED Received command 'version-get'
2023-02-20 11:24:59.974 INFO [kea-dhcp4.commands/1520.140217139232064] COMMAND_RECEIVED Received command 'status-get'
2023-02-20 11:24:59.979 INFO [kea-dhcp4.commands/1520.140217139232064] COMMAND_RECEIVED Received command 'config-get'
2023-02-20 11:25:21.568 INFO [kea-dhcp4.commands/1520.140217139232064] COMMAND_RECEIVED Received command 'statistic-get-all'
2023-02-20 11:25:21.586 INFO [kea-dhcp4.commands/1520.140217139232064] COMMAND_RECEIVED Received command 'subnet4-list'
2023-02-20 11:25:30.137 INFO [kea-dhcp4.commands/1520.140217139232064] COMMAND_RECEIVED Received command 'version-get'
2023-02-20 11:25:30.142 INFO [kea-dhcp4.commands/1520.140217139232064] COMMAND_RECEIVED Received command 'status-get'
2023-02-20 11:25:30.146 INFO [kea-dhcp4.commands/1520.140217139232064] COMMAND_RECEIVED Received command 'config-get'
2023-02-20 11:25:51.559 INFO [kea-dhcp4.commands/1520.140217139232064] COMMAND_RECEIVED Received command 'statistic-get-all'
2023-02-20 11:25:51.579 INFO [kea-dhcp4.commands/1520.140217139232064] COMMAND_RECEIVED Received command 'subnet4-list'
2023-02-20 11:25:52.194 INFO [kea-dhcp4.commands/1520.140217139232064] COMMAND_RECEIVED Received command 'stat-lease4-get'
2023-02-20 11:25:52.194 INFO [kea-dhcp4.stat-cmds-hooks/1520.140217139232064] STAT_CMDS_LEASE4_GET stat-lease4-get command successful,
parameters: [all subnets] rows found: 1
2023-02-20 11:25:52.198 INFO [kea-dhcp4.commands/1520.140217139232064] COMMAND_RECEIVED Received command 'statistic-get'
2023-02-20 11:26:00.497 INFO [kea-dhcp4.commands/1520.140217139232064] COMMAND_RECEIVED Received command 'version-get'
2023-02-20 11:26:00.500 INFO [kea-dhcp4.commands/1520.140217139232064] COMMAND_RECEIVED Received command 'status-get'
2023-02-20 11:26:00.504 INFO [kea-dhcp4.commands/1520.140217139232064] COMMAND_RECEIVED Received command 'config-get'
2023-02-20 11:26:21.563 INFO [kea-dhcp4.commands/1520.140217139232064] COMMAND_RECEIVED Received command 'statistic-get-all'
2023-02-20 11:26:21.580 INFO [kea-dhcp4.commands/1520.140217139232064] COMMAND_RECEIVED Received command 'subnet4-list'
2023-02-20 11:26:30.809 INFO [kea-dhcp4.commands/1520.140217139232064] COMMAND_RECEIVED Received command 'version-get'
2023-02-20 11:26:30.814 INFO [kea-dhcp4.commands/1520.140217139232064] COMMAND_RECEIVED Received command 'status-get'
2023-02-20 11:26:30.817 INFO [kea-dhcp4.commands/1520.140217139232064] COMMAND_RECEIVED Received command 'config-get'
```

# New: RPS (Response Per Second) statistics

Services Status									
Host	App Version	App Name	Daemon	Status	RPS (15min)	RPS (24h)	HA State	Detected Failure w/HA	Uptime
home01	Kea 2.2.0	kea@172.22.1.8	dhcp4	✓	34	2056	⊘ not configured		1 m 13 d 22 h 54 min 35 s

# New: Kea configuration checkers

[Home](#) > [Configuration](#) > [Review Checkers](#)


## Checkers list

State	Name	Description	Selectors	Triggers
<input checked="" type="checkbox"/> Enabled	canonical_prefix	The checker verifying if subnet prefixes are in the canonical form.	kea-dhcp-daemon	manual  config change
<input checked="" type="checkbox"/> Enabled	dispensable_shared_network	The checker verifying if a shared network can be removed because it is empty or contains only one subnet.	kea-dhcp-daemon	manual  config change
<input checked="" type="checkbox"/> Enabled	dispensable_subnet	The checker verifying if a subnet can be removed because it includes no pools and no reservations. The check is skipped when the host_cmds hook library is loaded because host reservations may be present in the database.	kea-dhcp-daemon	manual  config change host reservations change
<input checked="" type="checkbox"/> Enabled	host_cmds_presence	The checker verifying if the host_cmds hooks library is loaded when host backend is in use.	kea-dhcp-daemon	manual  config change
<input checked="" type="checkbox"/> Enabled	out_of_pool_reservation	The checker suggesting the use of out-of-pool host reservation mode when there are subnets with all host reservations outside of the dynamic pools.	kea-dhcp-daemon	manual  config change host reservations change
<input checked="" type="checkbox"/> Enabled	overlapping_subnet	The checker verifying if subnet prefixes do not overlap.	kea-dhcp-daemon	manual  config change
<input checked="" type="checkbox"/> Enabled	stat_cmds_presence	The checker verifying if the stat_cmds hooks library is loaded.	kea-dhcp-daemon	manual  config change

Submit

Reset



# New: Dump machine configuration to file

The screenshot displays the Kea Admin interface for the IP address 172.22.1.8:8468. The left sidebar shows system information, and the main area displays application details for Kea and BIND. A file browser window is overlaid on the right, showing a directory named 'stork-machine-3-dump\_2023-02-20T11-27-31Z' containing several JSON files. A red arrow points from the 'Dump Troubleshooting Data' button in the UI to the file browser window.

**System Information**

Address	172.22.1.8:8468
Hostname	home01
Agent Version	1.9.0
CPU	4
CPU Load	0.04 0.48 0.53
Memory	9 GiB
Used Memory	41 %
Uptime	44 days
OS	linux
Platform Family	fedora
Platform	fedora
Platform Version	37
Kernel Version	6.0.13-300.fc37.x86_64
Kernel Arch	x86_64
Virtualization Role	host
Host ID	47a81f1b-bfac-4b21-8ac5-8ea68f11d96b
Last Visited	2023-02-20 12:26:57

**Applications**

**Kea App (kea@172.22.1.8)**

Version 2.2.0  
✓ DHCPv4 ⚪ DHCPv6 ⚪ DDNS ✓ CA

**BIND 9 App**


Version BIND 9.18.11 (Stable Release) <id:>  
✓ named

**File Browser: stork-machine-3-dump\_2023-02-20T11-27-31Z**

Name	Date Modified	Size	Kind
events_latest_2023-02-20T11-27-31Z.json	Today at 12:27	159 KB	JSON Document
logs_a-2-kea@172.22.1.8_d-7-dhcp4_t-1-kea-dhcp4_2023-02-20T11-27-31Z.json	Today at 12:27	5 KB	JSON Document
machine_3-172.22.1.8_2023-02-20T11-27-31Z.json	Today at 12:27	46 KB	JSON Document
server-settings_all_2023-02-20T11-27-31Z.json	Today at 12:27	323 bytes	JSON Document
summary_executed-steps_2023-02-20T11-27-31Z.json	Today at 12:27	896 bytes	JSON Document


5 items, 17,55 GB available

# New: View Kea JSON Configuration

 DHCP ▾ Services ▾ Monitoring ▾ Configuration ▾ Help ▾

Search

[→ Logout (admin) ▾]

Home > Services > Kea Apps > App > Daemons > Daemon > Configuration

JSON

Expand Refresh Download

▼ Dhcp4:

allocator: "iterative"

authoritative: false

boot-file-name: ""

calculate-tee-times: false

▶ control-socket: {...}

ddns-generated-prefix: "myhost"

ddns-override-client-update: false

ddns-override-no-update: false

ddns-qualifying-suffix: ""

ddns-replace-client-name: "never"

ddns-send-updates: true

ddns-update-on-renew: false

ddns-use-conflict-resolution: true

decline-probation-period: 86400

▼ dhcp-ddns:

enable-updates: false

max-queue-size: 1024

ncr-format: "JSON"

ncr-protocol: "UDP"

sender-ip: "0.0.0.0"

sender-port: 0

server-ip: "127.0.0.1"

server-port: 53001

# New: Prometheus exporter and Grafana Dashboard Updates

- Extended Kea DHCP exporter for Prometheus
- The Stork Agent now contains a BIND 9 exporter for Prometheus
  - The exporter is based on `bind_exporter` from Digital Ocean  
[https://github.com/prometheus-community/bind\\_exporter](https://github.com/prometheus-community/bind_exporter)

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# Stork Installation

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# Stork Installation

- The hands-on workshop webpage at <https://webinar.defaultroutes.de/webinar/14-kea-stork-workshop.html> contains a step by step guide of how to install Kea-DHCP, BIND 9, Stork, PostgreSQL, Prometheus and Grafana on Red Hat EL 9 compatible systems

## **(Manual) Installation from packages**

- ISC offers ready made packages for major Linux distributions (Red Hat compatible, Debian compatible, Alpine Linux)
  - <https://cloudsmith.io/~isc/repos/stork/setup/>
- Choice between open-source and support subscription repositories

# (Automated) Installation using installation scripts

- The Stork manual (<https://stork.readthedocs.io/en/latest/install.html>) contains instructions on shell scripts that can be downloaded from the Cloudsmith repositories that will automate the installation process.
  - The scripts support Debian, Red Hat compatible systems and Alpine Linux
  - In security sensitive environments, these scripts should be first downloaded, inspected and executed with care

## Installation from Container Images

- The Stork Source code repository contains source code and scripts to generate an extensive demo environment with multiple Kea-DHCP instances, BIND 9 and Stork
  - These can be used as a starting point for own Container images (using Docker, Podman or similar container engines)



# Installation of Database

- Stork requires a PostgreSQL database installation
  - works fine sharing one PostgreSQL instance between Stork and Kea-DHCP
  - Requires the pgcrypto extension

# Stork Server and Agent Configuration

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# Stork Server and Agent Configuration

- Stork-Server and Stork-Agent are configured through environment variables or through command line switches
  - There are no configuration files
- These environment variables are injected into the process environment from a service management system (such as `systemd`)
- Further configuration is done through the Stork Web-UI and stored in the PostgreSQL database

# Configuration of Stork Server (env files)

```
### database settings
STORK_DATABASE_HOST=127.0.0.1
STORK_DATABASE_PORT=5432
STORK_DATABASE_NAME=stork_db
STORK_DATABASE_USER_NAME=stork
STORK_DATABASE_PASSWORD=secure-password

### REST API settings
STORK_REST_HOST=127.0.0.1
STORK_REST_PORT=9877
STORK_REST_STATIC_FILES_DIR=/usr/share/stork/www

### enable Prometheus /metrics HTTP endpoint for exporting metrics from
### the server to Prometheus. It is recommended to secure this endpoint
### (e.g. using HTTP proxy).
STORK_SERVER_ENABLE_METRICS=true

### Logging parameters
STORK_LOG_LEVEL=WARNING
CLICOLOR=false
```

# Configuration of Stork Agent (env files)

```
STORK_AGENT_HOST=127.0.0.1
STORK_AGENT_PORT=9878

STORK_AGENT_LISTEN_STORK_ONLY=false
STORK_AGENT_LISTEN_PROMETHEUS_ONLY=false

STORK_AGENT_PROMETHEUS_KEA_EXPORTER_ADDRESS=127.0.0.1
STORK_AGENT_PROMETHEUS_KEA_EXPORTER_PORT=9879
STORK_AGENT_PROMETHEUS_KEA_EXPORTER_INTERVAL=60
STORK_AGENT_PROMETHEUS_KEA_EXPORTER_PER_SUBNET_STATS=true

STORK_AGENT_PROMETHEUS_BIND9_EXPORTER_ADDRESS=127.0.0.1
STORK_AGENT_PROMETHEUS_BIND9_EXPORTER_PORT=9119
STORK_AGENT_PROMETHEUS_BIND9_EXPORTER_INTERVAL=60

STORK_AGENT_SERVER_URL=http://127.0.0.1:9877
STORK_AGENT_SKIP_TLS_CERT_VERIFICATION=true

### Logging parameters

### Set logging level. Supported values are: DEBUG, INFO, WARN, ERROR
STORK_LOG_LEVEL=WARN
CLICOLOR=false
```

# Securing Stork

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## Securing communication with TLS

- The communication between Stork Agents and the Stork Server can be secured with TLS encryption based on x.509 certificates
  - Public CA certificates, as well as private CA or "self-signed" certificates are possible
- The communication between Stork Server and the PostgreSQL database can also be secured with TLS

# Stork-Tool

- `stork-tool` is a new command line utility that can be used to import or export TLS certificates from Stork
- The tool can also be used to maintain the Stork database (init, upgrade, downgrade and checking the database schema version)
- See <https://stork.readthedocs.io/en/latest/man/stork-tool.8.html>



# Importing the Grafana Dashboards

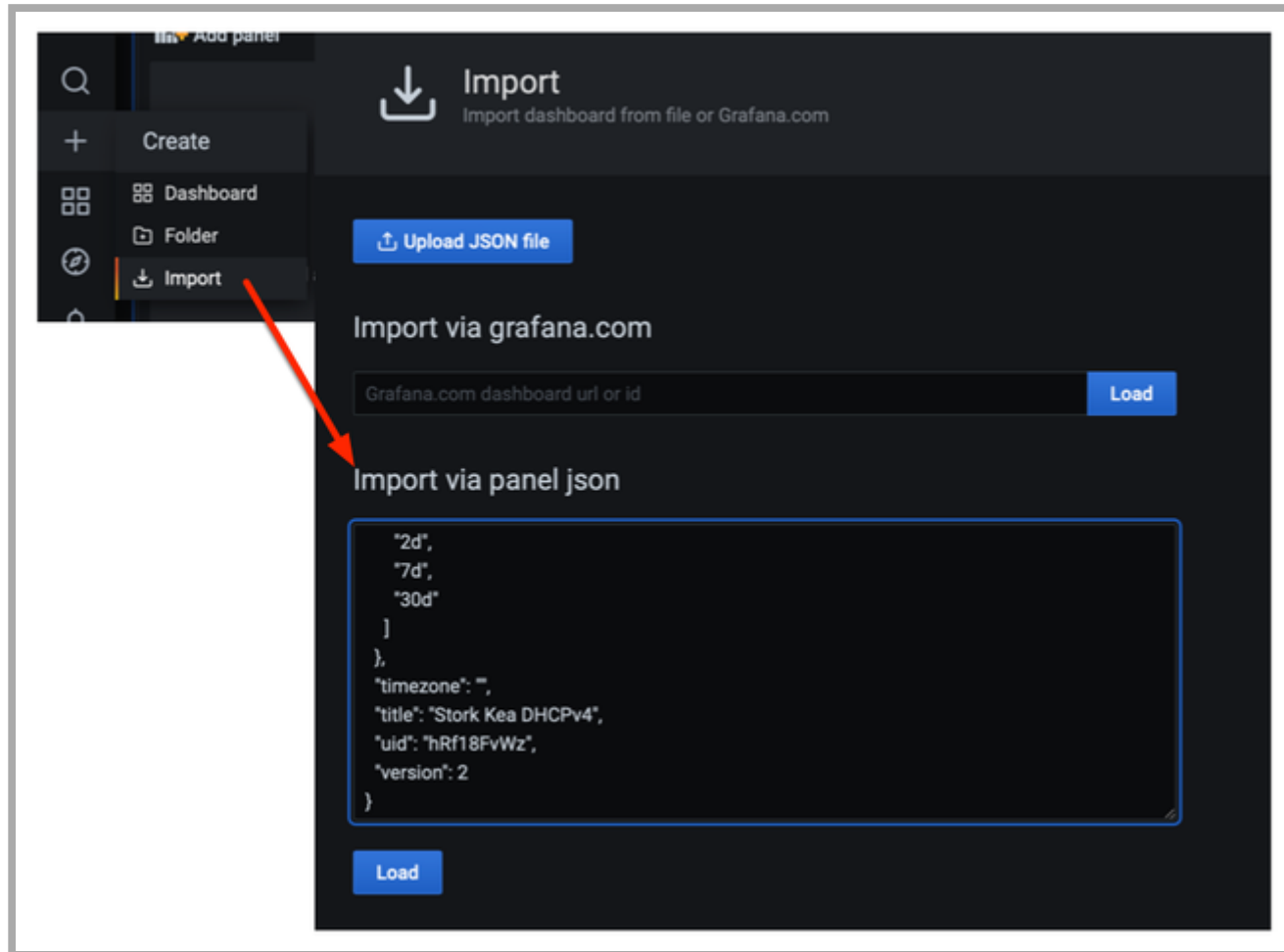
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# Importing the Grafana Dashboards

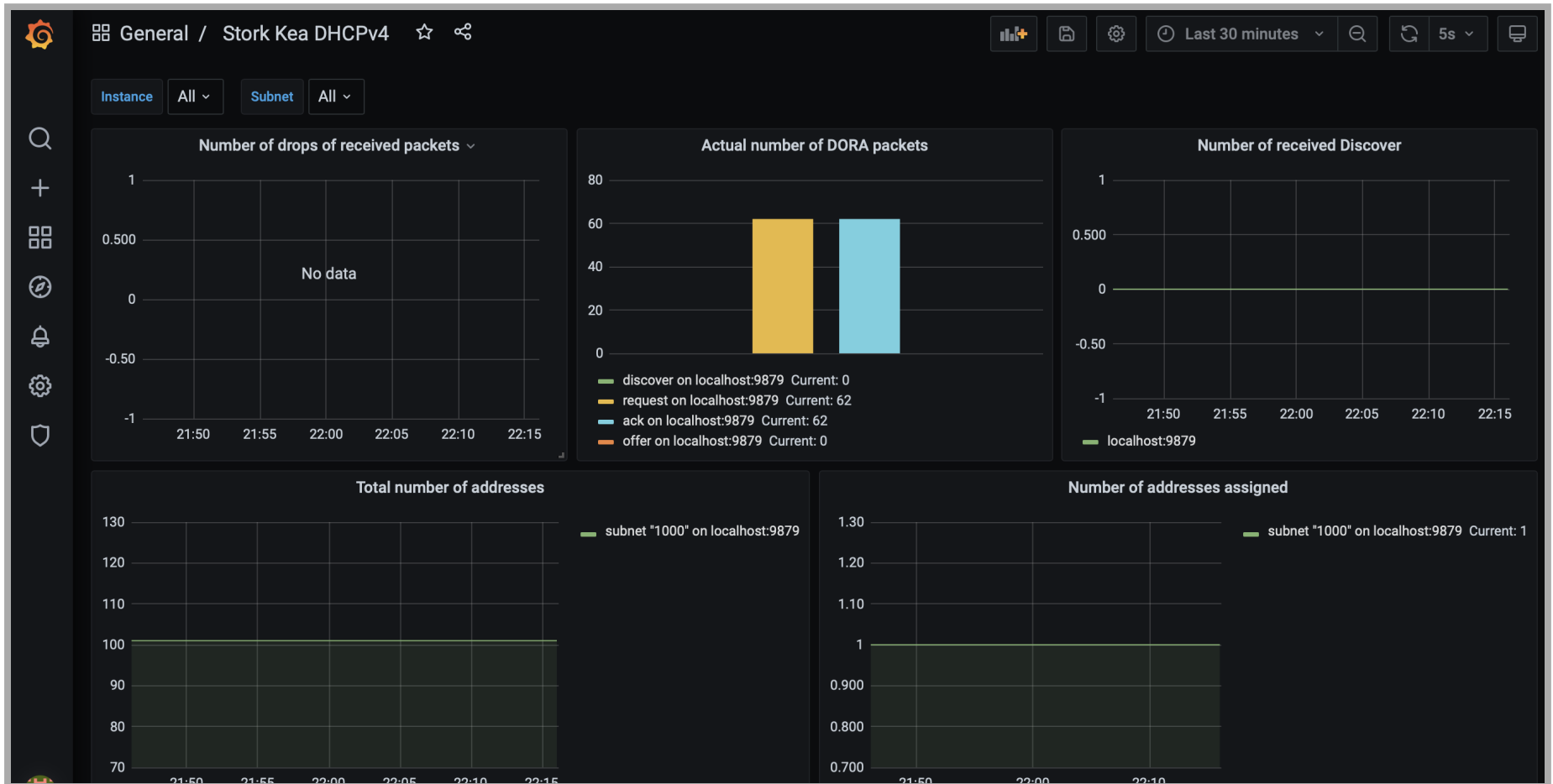
- Stork comes with ready made Grafana Dashboard configurations for Kea-DHCP4, Kea-DHCP6 and BIND 9 metrics data
- The dashboard definitions can be found as JSON source in `/usr/share/stork/examples/grafana`
- The files can be imported into Grafana using copy-n-paste

```
# ls -l /usr/share/stork/examples/grafana
total 108
-rw-rw-rw-. 1 root root 43169 Jan 31 09:02 bind9-resolver.json
-rw-rw-rw-. 1 root root 28474 Jan 31 09:02 kea-dhcp4.json
-rw-rw-rw-. 1 root root 36025 Jan 31 09:02 kea-dhcp6.json
```

# Importing the Grafana Dashboards



# Importing the Grafana Dashboards



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# Manage Reservations with Stork

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## Reservations in the SQL database

- Kea DHCP (both the IPv4 and IPv6 DHCP server) can either have leases in the configuration or in a SQL database system (PostgreSQL or MySQL/MariaDB)
  - For conflicting reservation information, the configuration file has priority over the database content

# Database configuration

```
[...]
  "hosts-database": {
    "type": "postgresql",
    "host": "localhost",
    "name": "kea_host_db",
    "user": "kea",
    "password": "secure-password"
  },
[...]
```

## Host Commands Hook


- Stork will display the reservations available both in the configuration file and in the database
- To be able to manage the reservations in the database, the (non-free) `hosts-cmds` hook needs to be installed and loaded into the Kea-DHCP Server




# Host Commands Hook


```
[...]
  "hooks-libraries": [
    {
      "library": "/usr/lib64/kea/hooks/libdhcp_stat_cmds.so",
      "parameters": { }
    },
    {
      "library": "/usr/lib64/kea/hooks/libdhcp_host_cmds.so",
      "parameters": { }
    }
  ],
[...]
```

# Entering a new Reservation

 DHCP ▾ Services ▾ Monitoring ▾ Configuration ▾ Help ▾  [→ Logout (admin) ▾]

🏠 > DHCP > Host Reservations 

**Host Reservations**

🔍 Filter hosts:  

[+ New Host](#) [↻ Refresh List](#)

DHCP Identifiers	IP Addresses	IPv6 Prefixes	Hostname	Global/Subnet	App Name
<a href="#">hw-address=(80:01:03:04:05:06)</a>	<a href="#">192.0.2.20</a>		some-host	192.0.2.0/24	<a href="#">kea@127.0.0.1</a> host_cmds
<a href="#">hw-address=(80:80:80:80:90:ff)</a>	<a href="#">2001:db8::1</a> <a href="#">2001:db8:100::1</a>		ipv6-host	global	<a href="#">kea@127.0.0.1</a> host_cmds

1 of 1 pages << < 1 > >> 10 ▾

# Entering a new Reservation

Stork

DHCP ▾ Services ▾ Monitoring ▾ Configuration ▾ Help ▾

Search

[→ Logout (admin) ▾]

[Home](#) > [DHCP](#) > [Host Reservations](#)

Host Reservations

New Host ✕

Form Settings

☐ Configure individual server values.

☐ Global reservation.

Assignments

DHCP Servers

kea@127.0.0.1/dhcp4

Subnet

DHCP Identifier

client-id ▾

text ▾

windows11POS

Host Reservations

Hostname

windows11POS

IPv4 address ▾

192.0.2.220

✕

# Entering a new Reservation

Boot Fields

Next Server

Server Hostname

Boot File Name

(2) Time Offset

(3) Router

(4) Time Server

(5) Name Server

(6) Domain Server

(7) Log Server

List

Use the dropdown to select an option from the list of standard options. If the option is not in the list, simply type its code (a number) in the box. When using the dropdown, it is possible to filter by option name or code.

☐ Always Send

Add binary

✗ Delete Option

Empty Option

Add More Options

Cancel

Submit

## Entering a new Reservation

- A new reservation might not be shown immediately in the Stork Web-UI
  - It will be written into the database immediately and will be active
  - It will be shown after the next sync of the Stork-Agent with the Kea-DHCP Server (can take a few seconds)

# Host-Reservation Demo

# Upcoming ISC Webinar

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- 30 Mar - Configuring vendor options in Kea
- 20 Apr - Netbox and Kea DHCP
- 16 May - Migrating to Kea from ISC DHCP
- 07 Jun - Using the new dynamic templates in Kea

# Questions / Answers

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# Hands-On:

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- Installing Kea/Bind/Stork/Prometheus/Grafana  
<https://webinar.defaultroutes.de/webinar/14-kea-stork-workshop.html>

