Kea Webinar

Monitoring, Logging and Stork

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18th November 2020

https://www.isc.org

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Welcome

- Welcome to part five of our webinar series "the KEA DHCP Server"

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About this Webinar

- Stork Dashboard for Kea
- A tour of Stork
- Other Monitoring options
- Logging in Kea
- Performance testing

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Stork Dashboard for Kea

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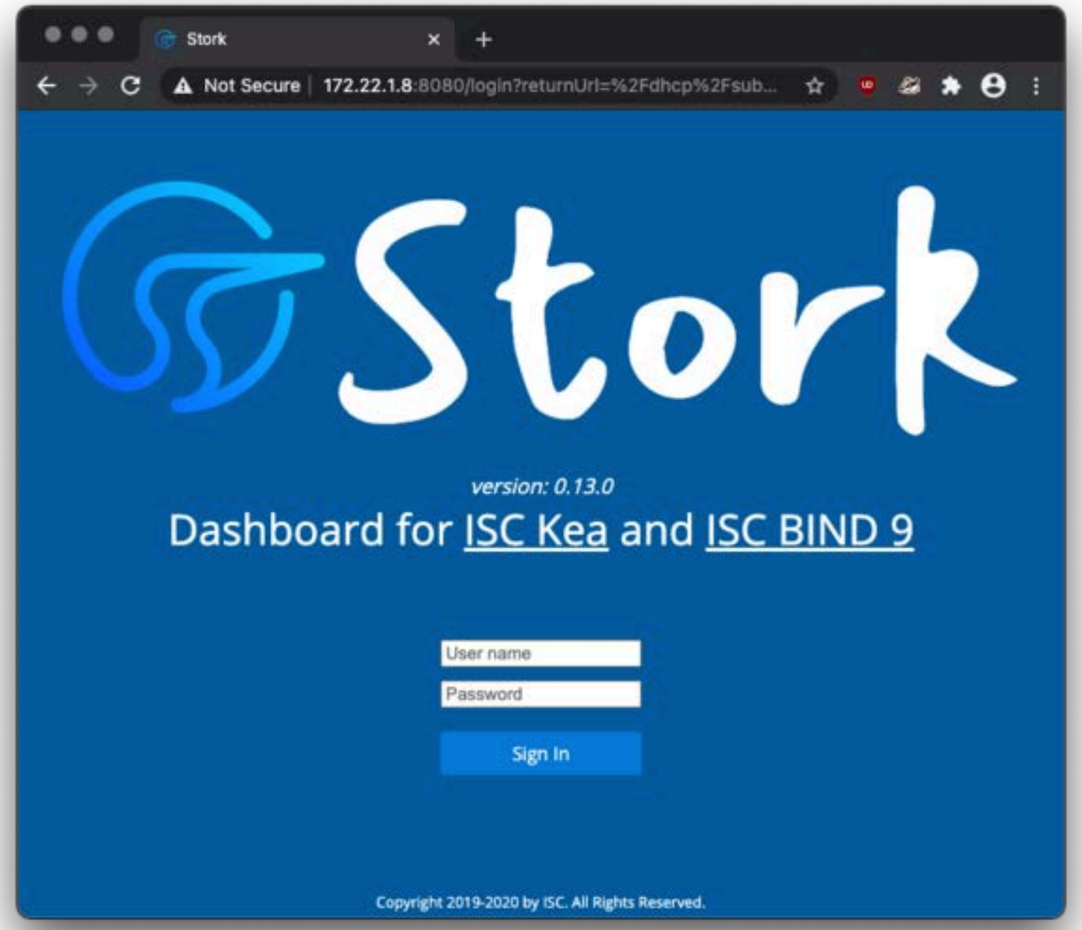
Stork Dashboard for Kea



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What is Stork?

- Stork is a dashboard for Kea DHCP
  - monitoring of Kea
  - monitoring of Kea High-Availability state
  - alerting mechanisms that indicate failures, fault conditions, and other unwanted events

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What is Stork?

- It is under active development
  - monthly releases
  - it is usable and useful
  - but not feature complete (as of November 2020)
  - there are rough edges

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Platforms

- Stork is available for
  - Ubuntu Linux (18.04 and 20.04)
  - Fedora Linux 31, 32 and 33
  - RedHat/CentOS 7/8
  - macOS*
- Stork might work on other Unix(ish) platforms
- Stork can run co-located with a Kea service, or can run on a dedicated machine

* macOS is not and will not be officially supported but the developers use and test on macOS

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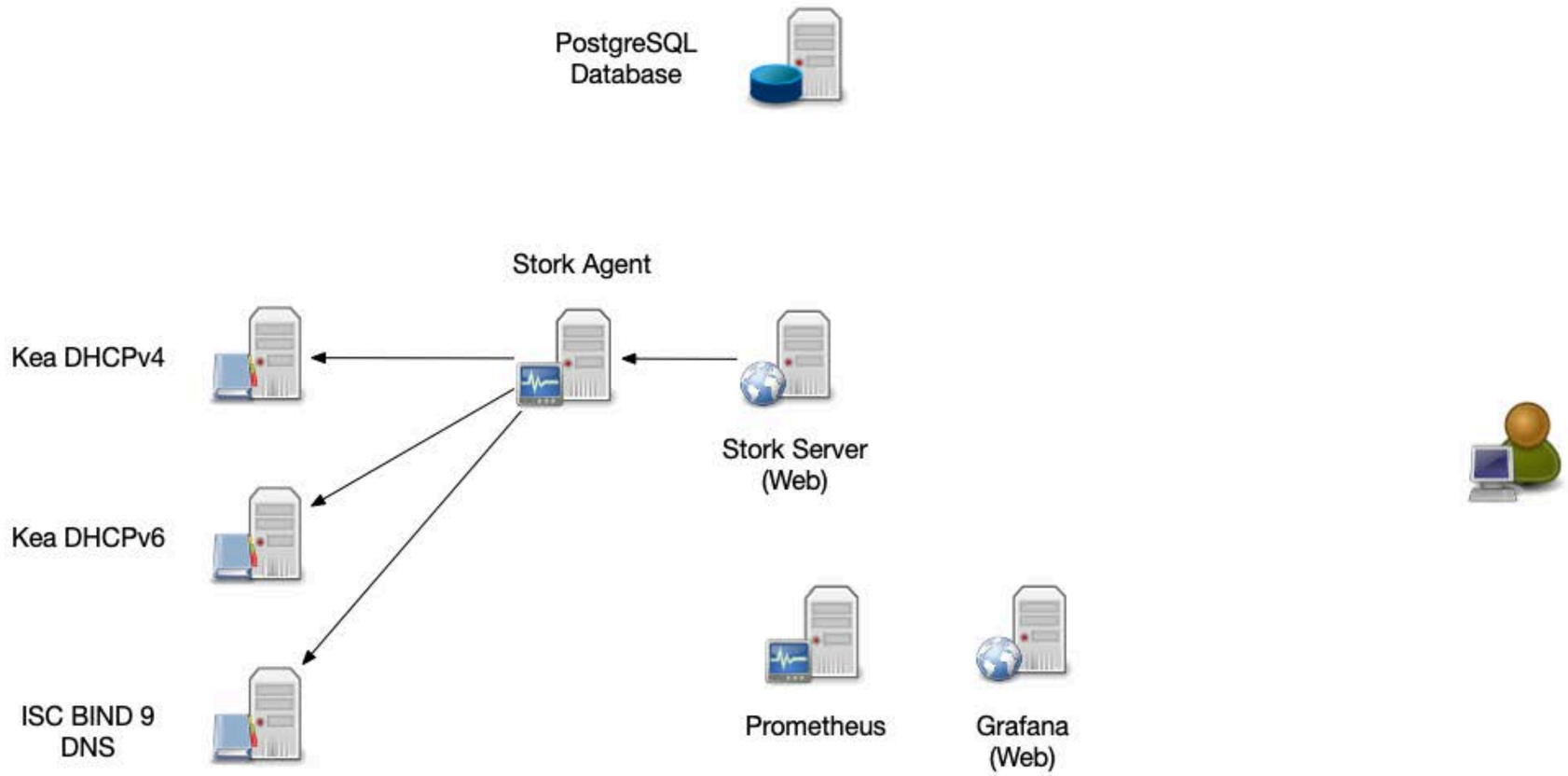
Architecture



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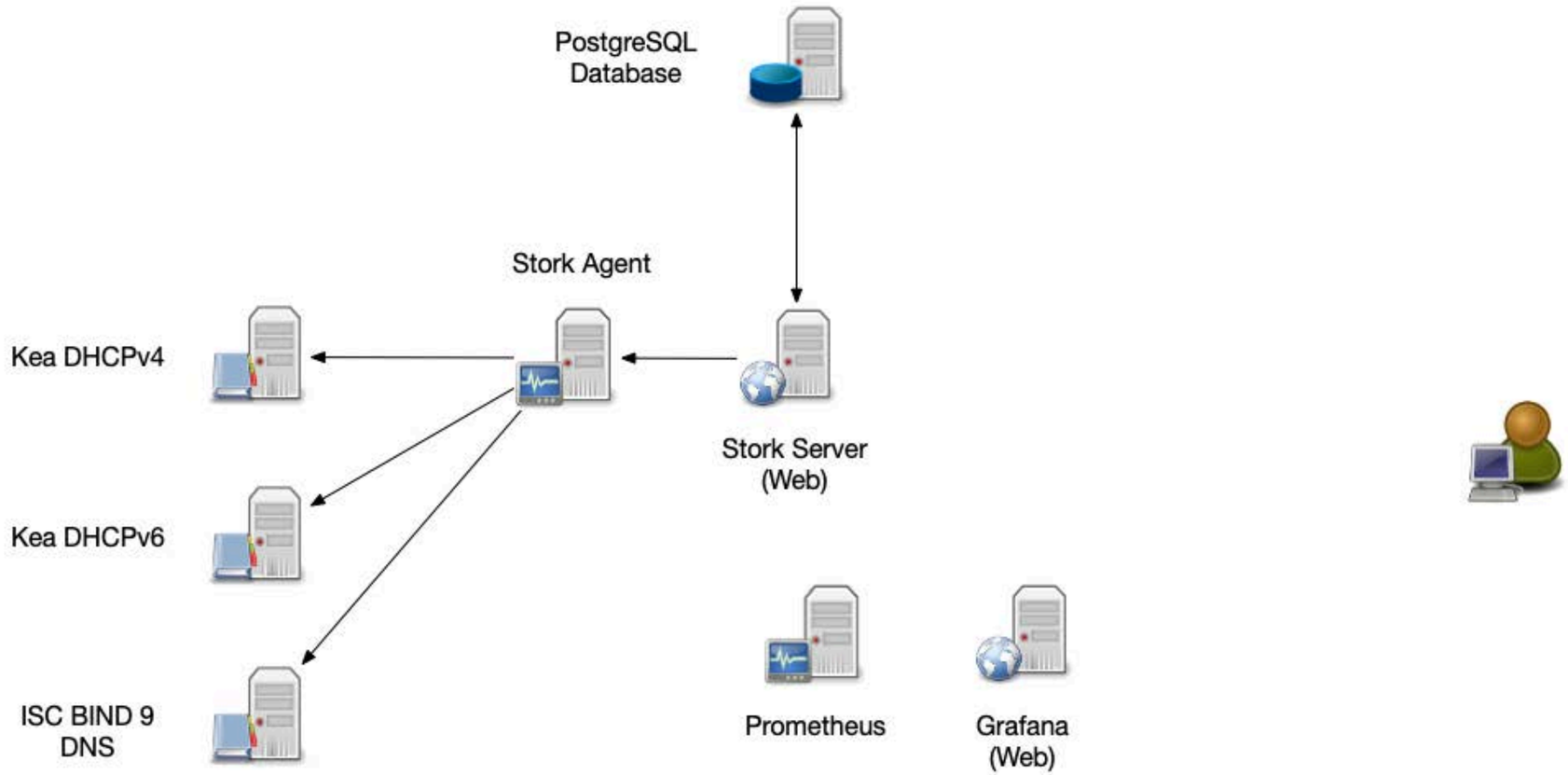
Architecture



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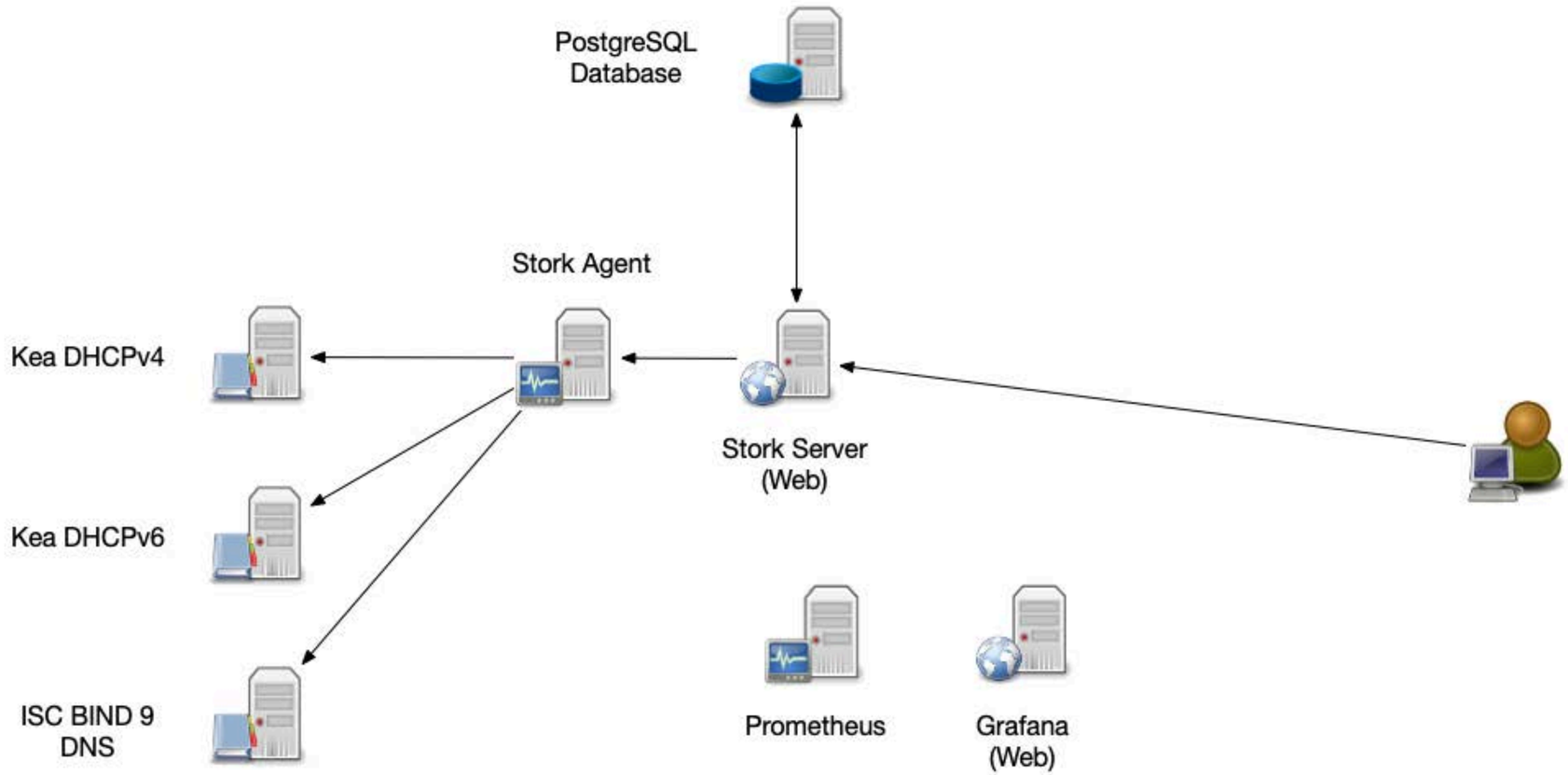
Architecture



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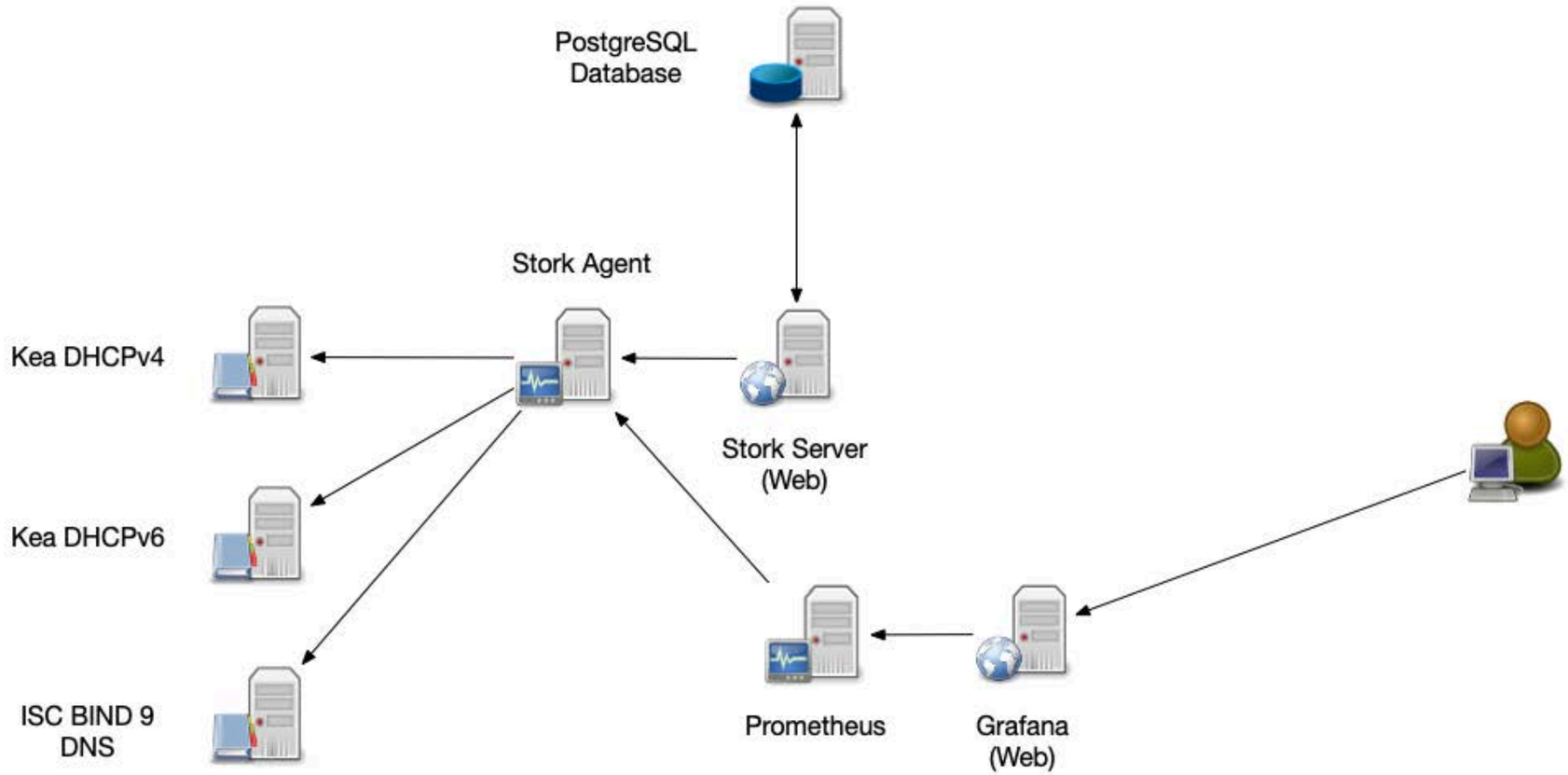
Architecture



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Requirements

- Kea Control Agent configured and running
- PostgreSQL Database (version 11 or later)

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Installation (from packages)

- Packages for Stork are available in the ISC repositories from cloudsmith.io
  - RedHat/CentOS/Fedora
  - Debian/Ubuntu

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Installation on CentOS 8

- Download and enable the repository data

```
# dnf install yum-utils pygpgme
# rpm --import 'https://dl.cloudsmith.io/public/isc/stork/cfg/gpg/gpg.77F64EC28053D1FB.key'
# curl -1sLf 'https://dl.cloudsmith.io/public/isc/stork/cfg/setup/config.rpm.txt?distro=fedora&codename=29' > /tmp/isc-stork.repo
```

- inspect the repository data, then enable the repository

```
# less /tmp/isc-stork.repo
# dnf config-manager --add-repo '/tmp/isc-stork.repo'
```

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Installation on CentOS 8

- Update the repository database

```
# dnf makecache  --enablerepo='isc-stork'
CentOS-8 - AppStream                                             46 kB/s | 4.3 kB     00:00
CentOS-8 - Base                                                  35 kB/s | 3.9 kB     00:00
CentOS-8 - Extras                                                17 kB/s | 1.5 kB     00:00
isc-stork                                                       186  B/s | 473  B     00:02
isc-stork                                                       3.4 kB/s | 967  B     00:00
Importing GPG key 0x8053D1FB:
 Userid     : "Cloudsmith Package (isc/stork) <support@cloudsmith.io>"
 Fingerprint: 7AB5 064B 08F0 69A1 A5CC 500C 77F6 4EC2 8053 D1FB
 From       : https://dl.cloudsmith.io/public/isc/stork/cfg/gpg/gpg.77F64EC28053D1FB.key
Is this ok [y/N]: y
[...]
```

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Installation on CentOS 8

- Install the Stork-Agent and -Server

```
# dnf install isc-stork-agent isc-stork-server
isc-stork                                                
```

PostgreSQL

- The Stork agent requires an PostgreSQL database to store configuration and historical monitoring data
- RedHat/CentOS 8 provides different version of the PostgreSQL database server in its AppStream repositories. Select the Version 12 (Version 10 is the default).

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PostgreSQL

```
[root@kea-test ~]# dnf module enable postgresql:12
isc-stork                                                                                                                                                675  B/s | 473  B     00:00
isc-stork-noarch                                                                                                                                         687  B/s | 473  B     00:00
isc-stork-source                                                                                                                                         636  B/s | 473  B     00:00
Dependencies resolved.
================================================================================================================================================================================
 Package                                  Architecture                          Version                                 Repository                                    Size
================================================================================================================================================================================
Enabling module streams:
 postgresql                                                                     12

Transaction Summary
================================================================================================================================================================================

Is this ok [y/N]:
```

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PostgreSQL

```
# dnf module list postgresql
# dnf module list postgresql
Last metadata expiration check: 0:03:10 ago on Fri 13 Nov 2020 11:00:55 AM CET.
CentOS-8 - AppStream
Name                                Stream                          Profiles                                Summary
postgresql                          9.6                             client, server [d]                      PostgreSQL server and client module
postgresql                          10 [d]                          client, server [d]                      PostgreSQL server and client module
postgresql                          12 [e]                          client, server [d]                      PostgreSQL server and client module

Hint: [d]efault, [e]nabled, [x]disabled, [i]nstalled
```

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PostgreSQL

```
# dnf install postgresql-server postgresql-contrib
Last metadata expiration check: 0:04:20 ago on Fri 13 Nov 2020 11:00:55 AM CET.
Dependencies resolved.
==========================================================================================================================================
 Package                                  Architecture                 Version                                                  Repository                        Size
==========================================================================================================================================
Installing:
 postgresql-server                        x86_64                       12.1-2.module_el8.1.0+273+979c16e6                       AppStream                        5.5 M
Installing dependencies:
 libicu                                   x86_64                       60.3-2.el8_1                                             BaseOS                           8.8 M
 libpq                                    x86_64                       12.4-1.el8_2                                             AppStream                        195 k
 postgresql                               x86_64                       12.1-2.module_el8.1.0+273+979c16e6                       AppStream                        1.4 M

Transaction Summary
==========================================================================================================================================
Install  4 Packages

Total download size: 16 M
Installed size: 62 M
Is this ok [y/N]:
```

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PostgreSQL

- Initialize the database

```
# postgresql-setup  --initdb
 * Initializing database in '/var/lib/pgsql/data'
 * Initialized, logs are in /var/lib/pgsql/initdb_postgresql.log
```

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PostgreSQL

- Start the PostgreSQL database system

```
# systemctl enable --now postgresql
Created symlink /etc/systemd/system/multi-user.target.wants/postgresql.service → /usr/lib/
systemd/system/postgresql.service.
```

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PostgreSQL

- create the user stork and an empty database stork_db for Stork:

```
# su - postgres
$ psql postgres
psql (12.1)
Type "help" for help.

postgres=# CREATE USER stork WITH PASSWORD 'secure-password';
CREATE ROLE
postgres=# CREATE DATABASE stork_db;
CREATE DATABASE
postgres=# GRANT ALL PRIVILEGES ON DATABASE stork_db TO stork;
GRANT
postgres=# \c stork_db
postgres=# CREATE EXTENSION pgcrypto;
CREATE EXTENSION
postgres=# \q
```

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Stork Agent configuration

- the Stork-Agent is configured via environment variables
  - the variables are defined in `/etc/stork/agent.env` and will be read by the init-system or systemd

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Stork Agent configuration

```
# address to bind ie. for listening
STORK_AGENT_ADDRESS=2001:db8:500::8547
STORK_AGENT_PORT=8547

# settings for exporting stats to Prometheus
STORK_AGENT_PROMETHEUS_KEA_EXPORTER_ADDRESS=192.0.2.47
STORK_AGENT_PROMETHEUS_KEA_EXPORTER_PORT=9547
STORK_AGENT_PROMETHEUS_KEA_EXPORTER_INTERVAL=60
```

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Starting the Stork Agent

- once the Agent configuration is complete, the Stork-Agent can be started

```
# systemctl enable --now isc-stork-agent
Created symlink /etc/systemd/system/multi-user.target.wants/isc-stork-agent.service → /usr/lib/systemd/system/isc-stork-agent.service.
[root@kea-test ~]# systemctl status isc-stork-agent
● isc-stork-agent.service - ISC Stork Agent
   Loaded: loaded (/usr/lib/systemd/system/isc-stork-agent.service; enabled; vendor preset: disabled)
   Active: active (running) since Fri 2020-11-13 11:23:28 CET; 9s ago
     Docs: man:stork-agent(8)
 Main PID: 5411 (stork-agent)
    Tasks: 6 (limit: 12210)
   Memory: 7.0M
   CGroup: /system.slice/isc-stork-agent.service
           └─5411 /usr/bin/stork-agent

Nov 13 11:23:28 kea-test systemd[1]: Started ISC Stork Agent.
Nov 13 11:23:28 kea-test stork-agent[5411]: INFO[2020-11-13 11:23:28]             main.go:75    Starting Stork Agent, version 0.13.0, build date 2020-11-04 14:47
Nov 13 11:23:28 kea-test stork-agent[5411]: INFO[2020-11-13 11:23:28]  promkeaexporter.go:272   Prometheus Kea Exporter listening on 0.0.0.0:9547, stats pulling interval>
Nov 13 11:23:28 kea-test stork-agent[5411]: INFO[2020-11-13 11:23:28]          monitor.go:80    Started app monitor
```

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Stork Server configuration

- the Stork-Server is configured via environment variables
  - the variables are defined in `/etc/stork/server.env` and will be read by the init-system or systemd

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Stork Server configuration

```
# database settings
STORK_DATABASE_HOST=192.0.2.55
STORK_DATABASE_NAME=stork_db
STORK_DATABASE_USER_NAME=stork
STORK_DATABASE_PASSWORD=secure-password

# ReST API settings
# STORK_REST_HOST=
# STORK_REST_PORT=
# STORK_REST_TLS_CERTIFICATE=
# STORK_REST_TLS_PRIVATE_KEY=
# STORK_REST_TLS_CA_CERTIFICATE=
STORK_REST_STATIC_FILES_DIR=/usr/share/stork/www
```

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Starting the Stork Server

```
# systemctl enable --now isc-stork-server
Created symlink /etc/systemd/system/multi-user.target.wants/isc-stork-server.service → /usr/lib/systemd/system/isc-stork-server.service.

# systemctl status isc-stork-server
● isc-stork-server.service - ISC Stork Server
   Loaded: loaded (/usr/lib/systemd/system/isc-stork-server.service; enabled; vendor preset: disabled)
   Active: active (running) since Fri 2020-11-13 12:22:13 CET; 2s ago
     Docs: man:stork-server(8)
 Main PID: 6984 (stork-server)
    Tasks: 7 (limit: 12210)
   Memory: 19.6M
   CGroup: /system.slice/isc-stork-server.service
           └─6984 /usr/bin/stork-server

Nov 13 12:22:13 kea-test stork-server[6984]: INFO[2020-11-13 12:22:13]           puller.go:38    starting Kea Hosts Puller
Nov 13 12:22:13 kea-test stork-server[6984]: INFO[2020-11-13 12:22:13]           puller.go:71    started Kea Hosts Puller
Nov 13 12:22:13 kea-test stork-server[6984]: INFO[2020-11-13 12:22:13]           puller.go:38    starting Kea Status Puller
Nov 13 12:22:13 kea-test stork-server[6984]: INFO[2020-11-13 12:22:13]           puller.go:71    started Kea Status Puller
Nov 13 12:22:13 kea-test stork-server[6984]: INFO[2020-11-13 12:22:13]      eventcenter.go:118   event 'started Stork server'
Nov 13 12:22:13 kea-test stork-server[6984]: INFO[2020-11-13 12:22:13]            main.go:25    Starting Stork Server, version 0.13.0, build date 2020-11-04 14:47
Nov 13 12:22:13 kea-test stork-server[6984]: INFO[2020-11-13 12:22:13]       middleware.go:48    installed file server middleware
Nov 13 12:22:13 kea-test stork-server[6984]: INFO[2020-11-13 12:22:13]       middleware.go:68    installed SSE middleware
Nov 13 12:22:13 kea-test stork-server[6984]: INFO[2020-11-13 12:22:13]       middleware.go:19    installed logging middleware
Nov 13 12:22:13 kea-test stork-server[6984]: INFO[2020-11-13 12:22:13]      restservice.go:241   started serving Stork Server                  address="http://[::]:8080"
```

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Prometheus

- Prometheus is a popular monitoring framework written in Go
  - `https://prometheus.io`
  - originally developed at SoundCloud
  - development is overseen by the Cloud Native Computing Foundation `https://cncf.io/`
- Stork can export monitoring information towards Prometheus
  - Stork is an Prometheus Exporter
  - The use of Prometheus for Stork is **optional**

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Grafana

- Grafana is a popular monitoring dashboard that can be used to visualize monitoring data from an Prometheus system
  - `https://grafana.com/`
  - Grafana provides additional visualization options for Kea DHCP data
  - The use of Grafana for Stork is **optional**

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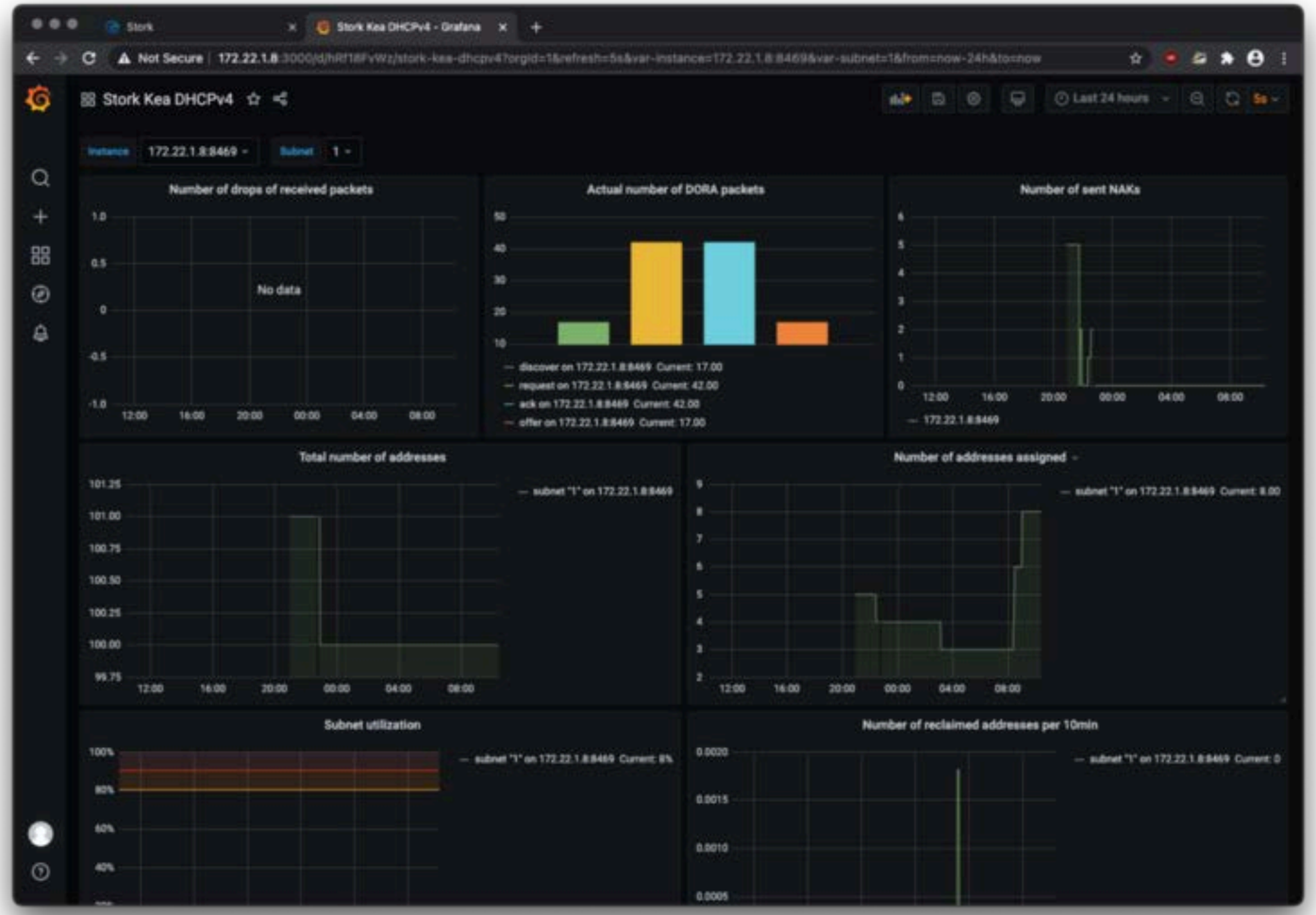
Grafana



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Tour a Stork

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User Management

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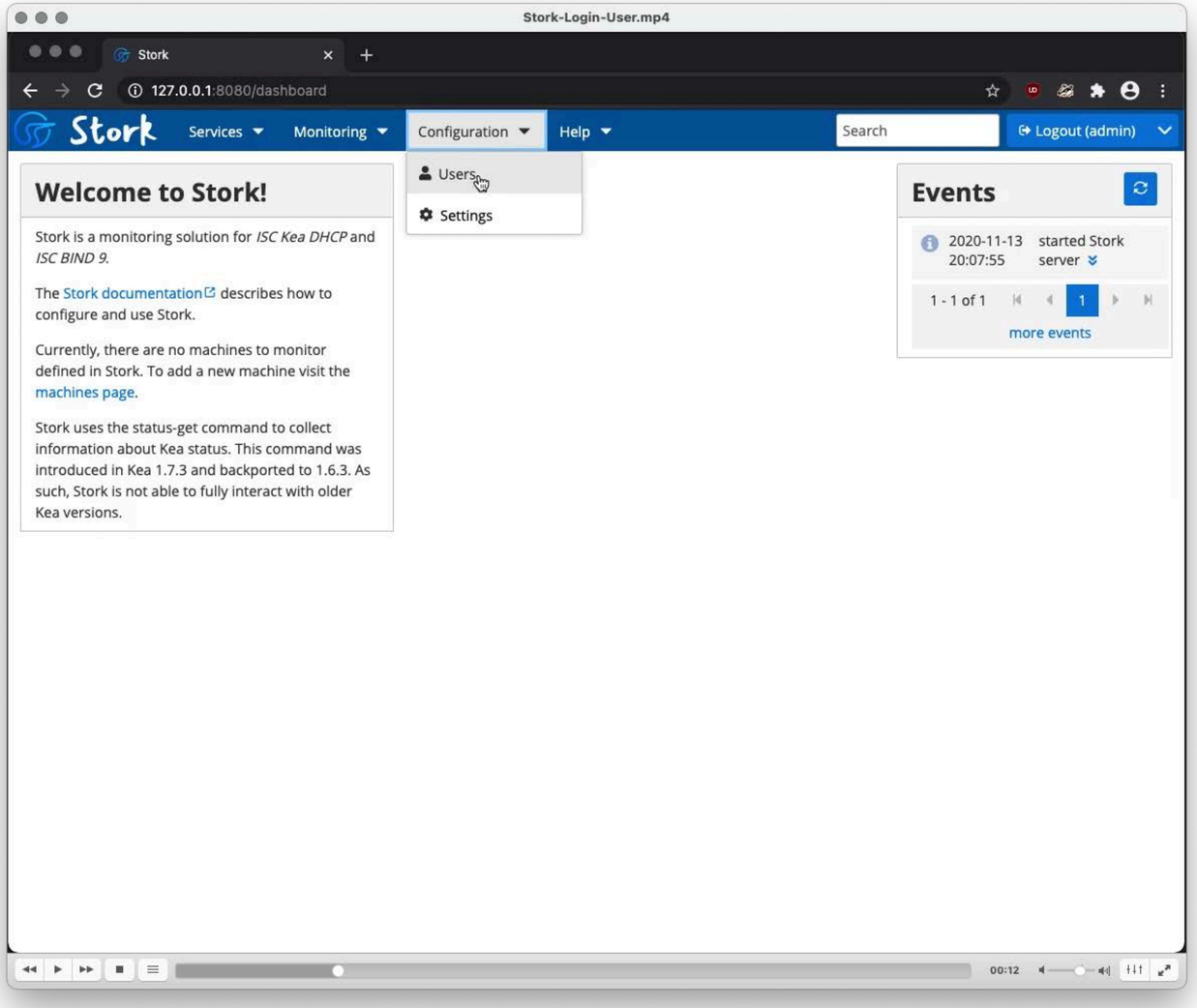
User Management



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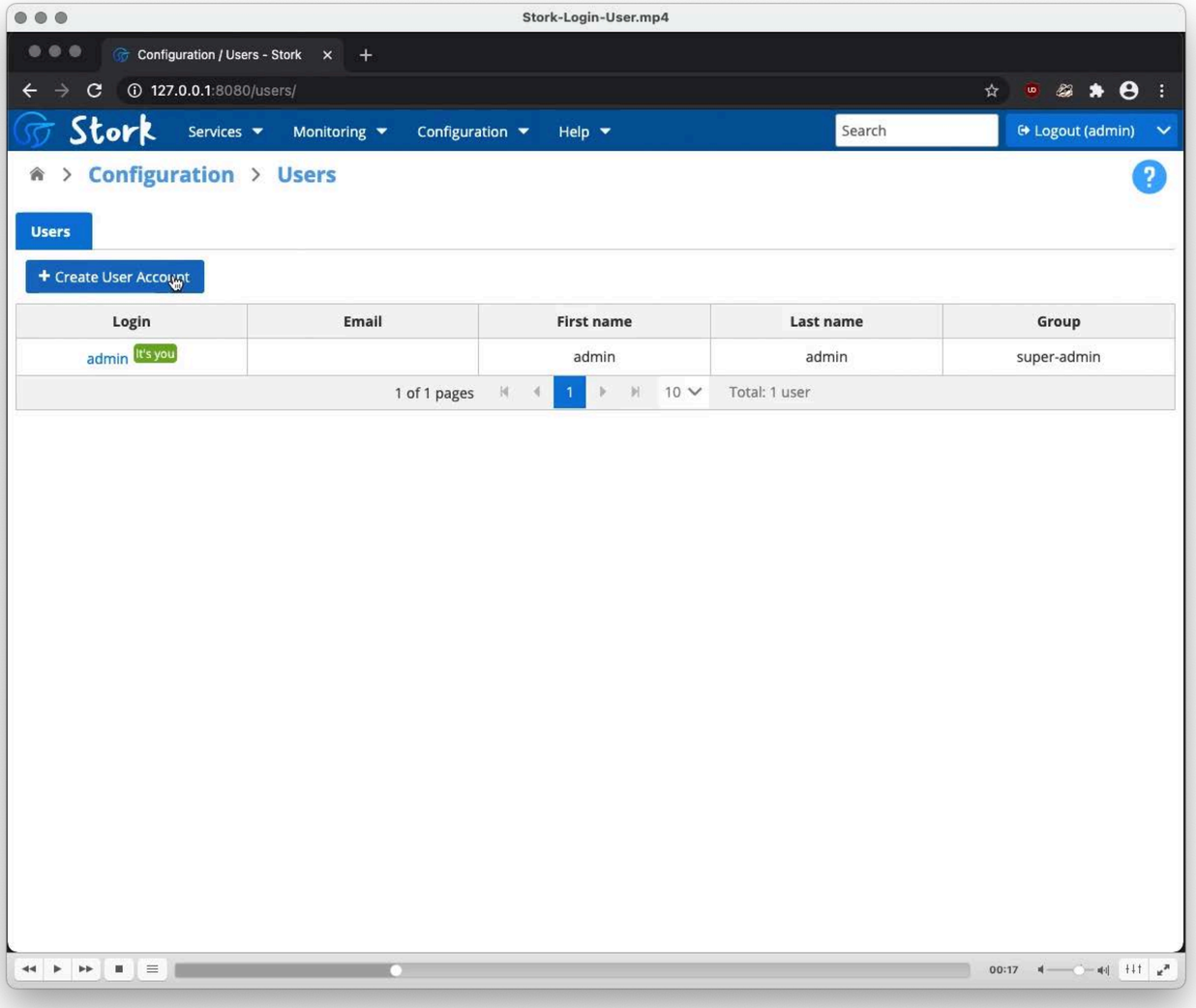
User Management



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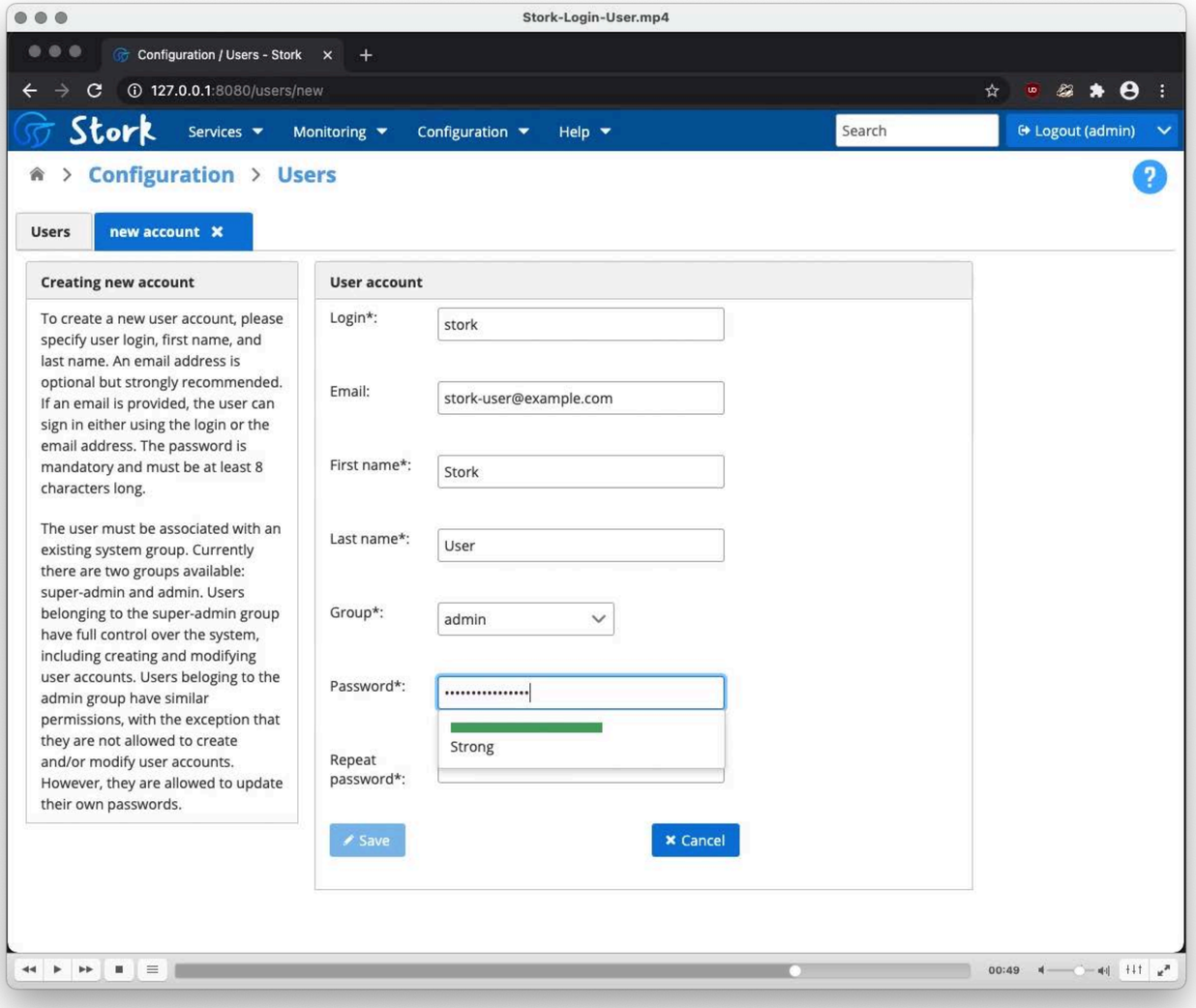
User Management



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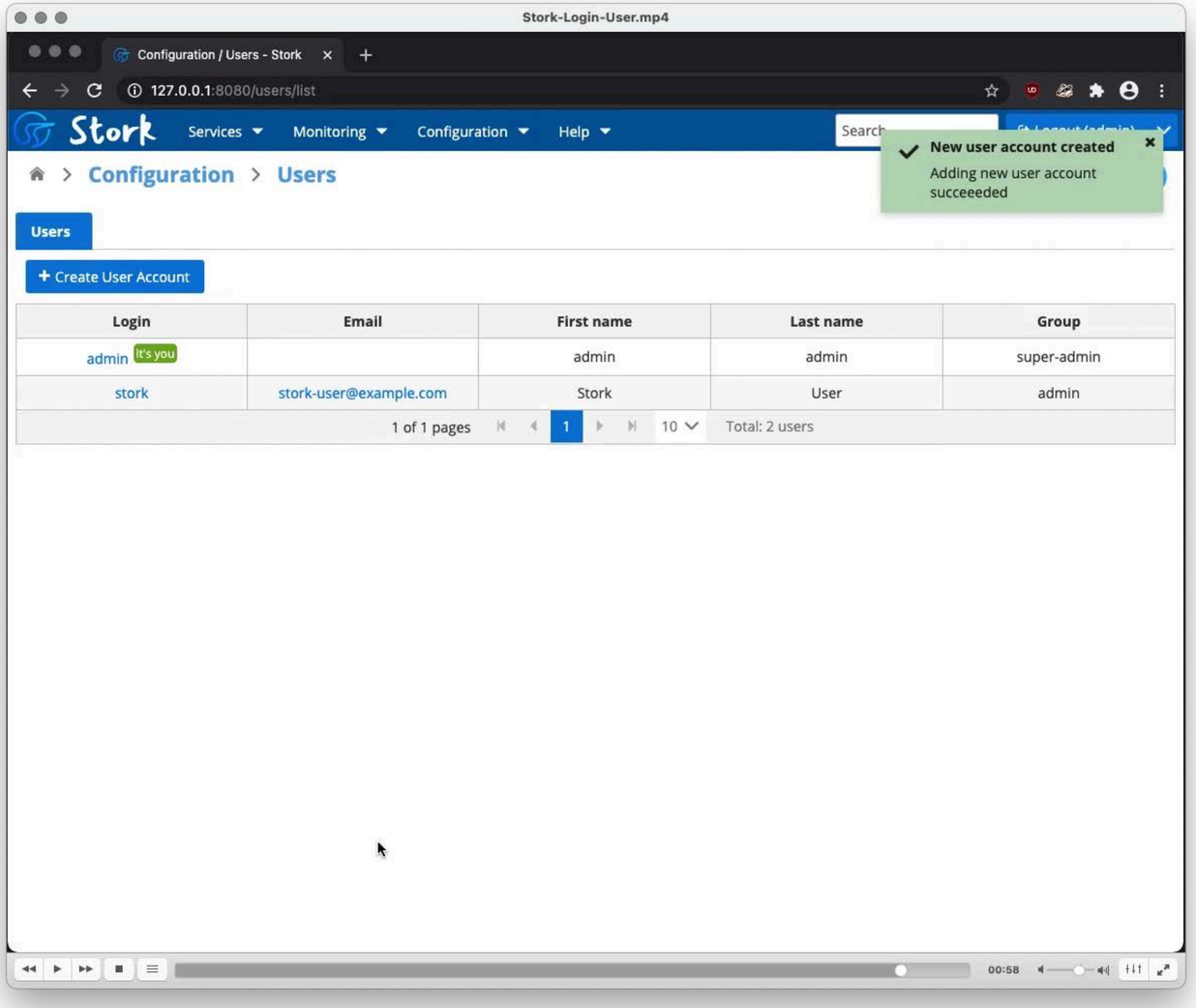
User Management



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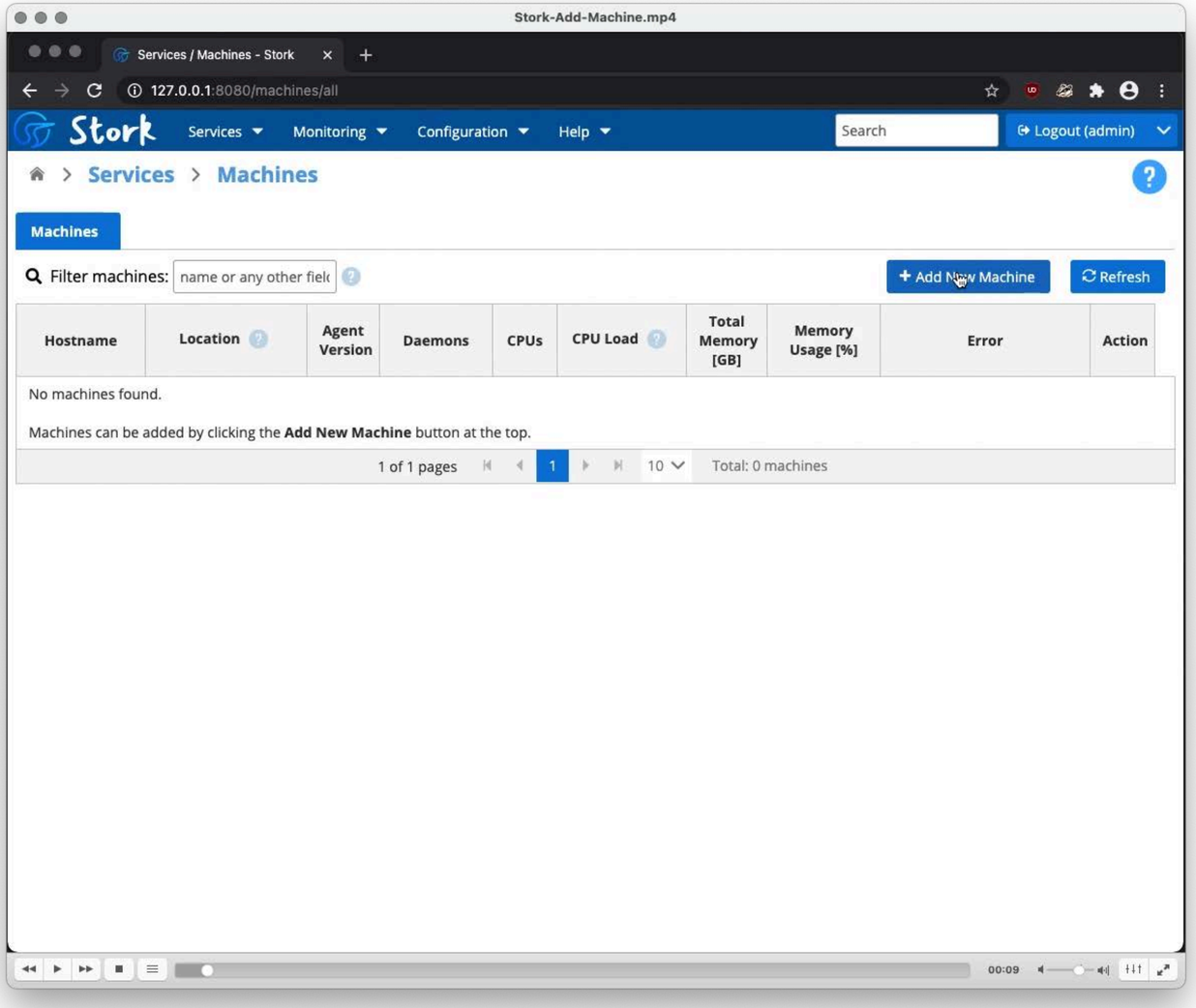
Adding Machines



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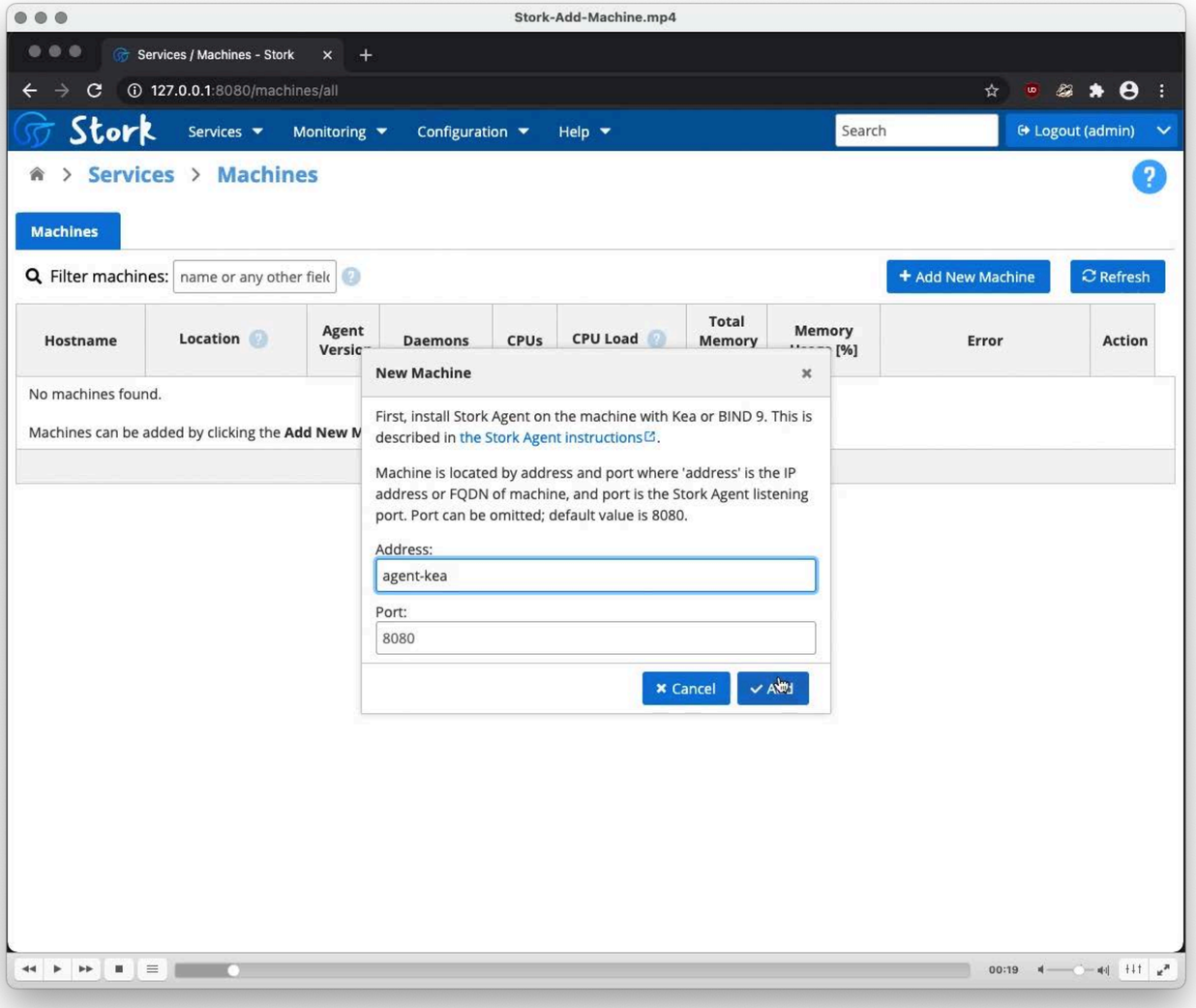
Adding Machines



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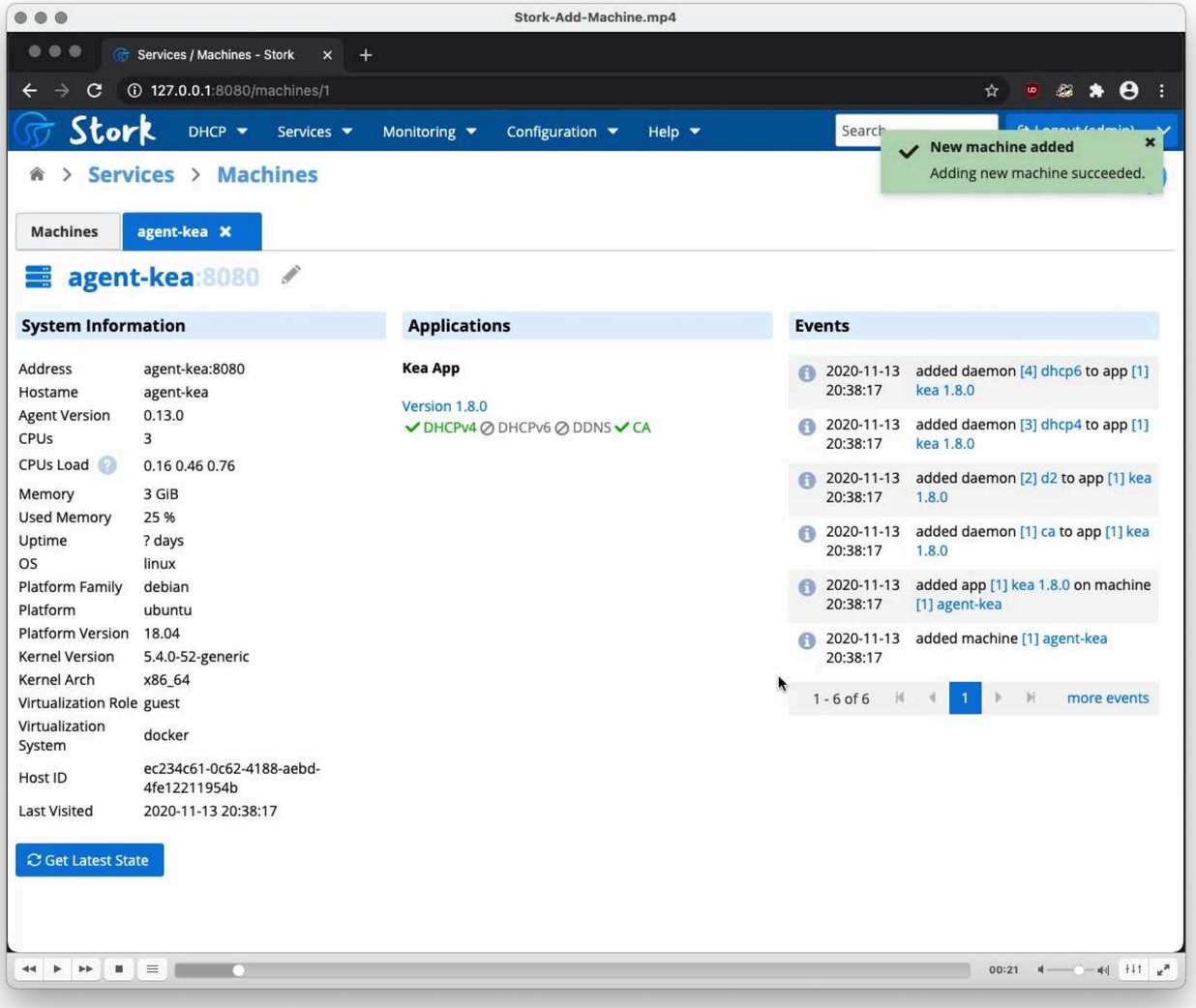
Adding Machines



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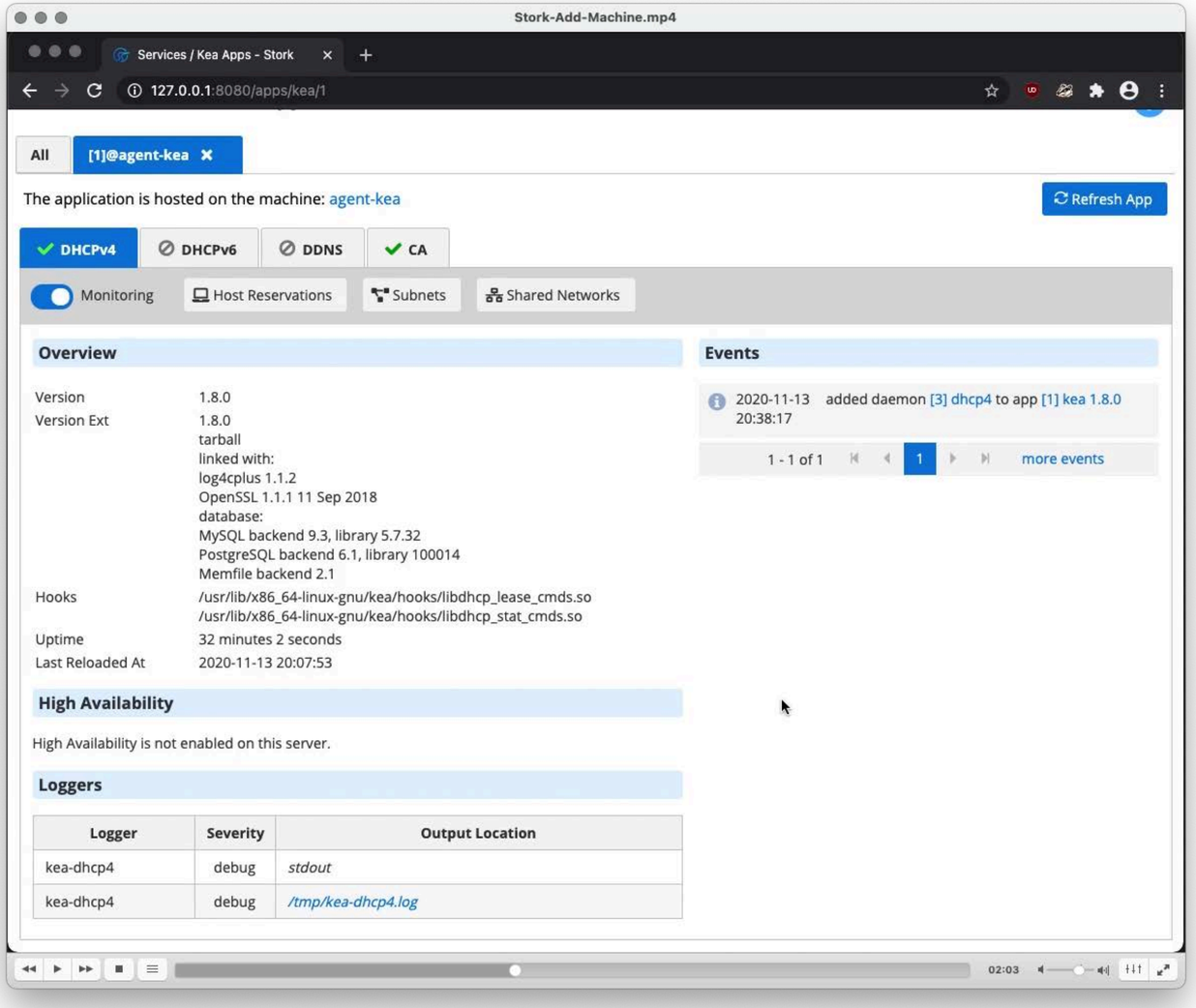
Adding Machines



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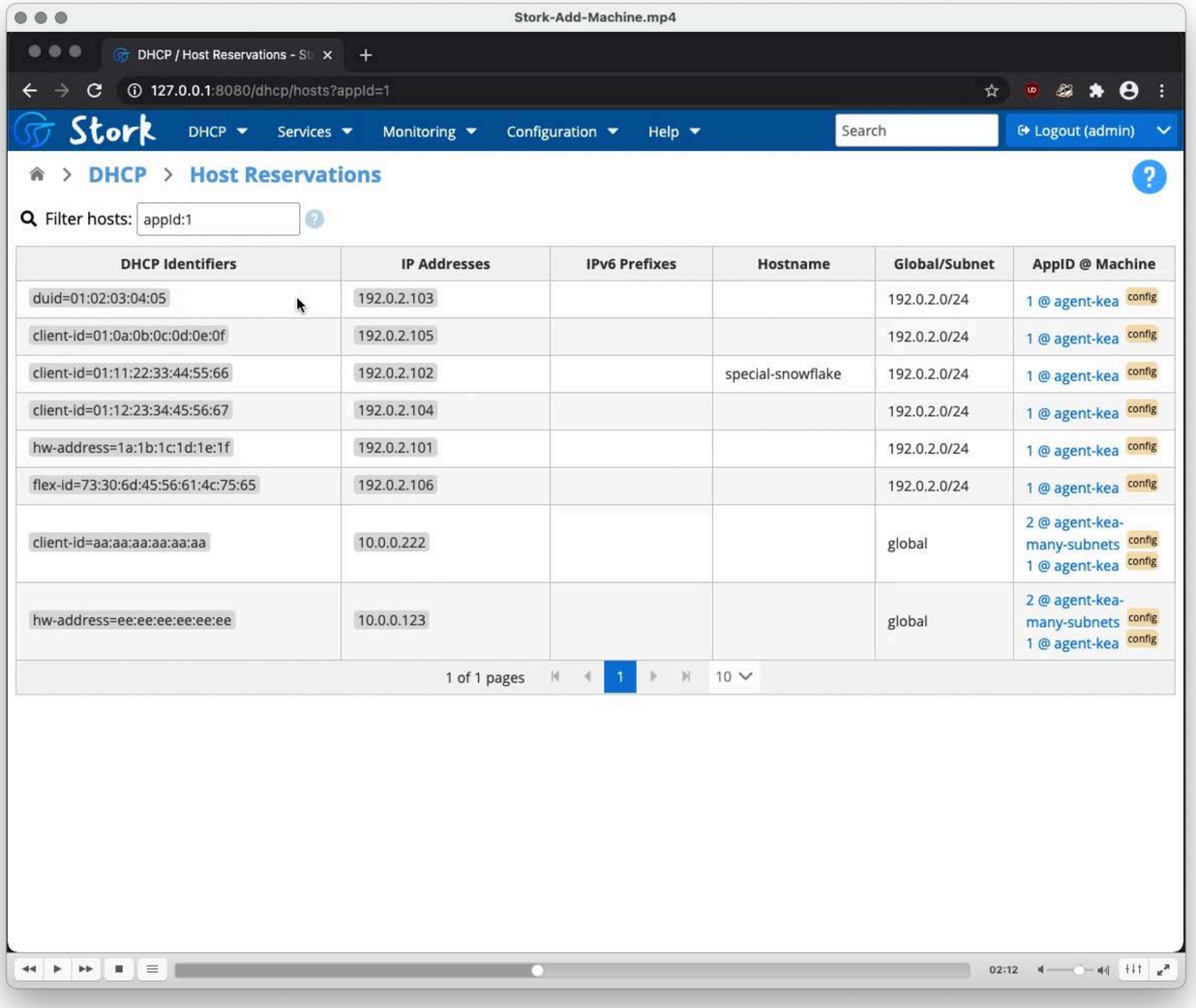
Status Information



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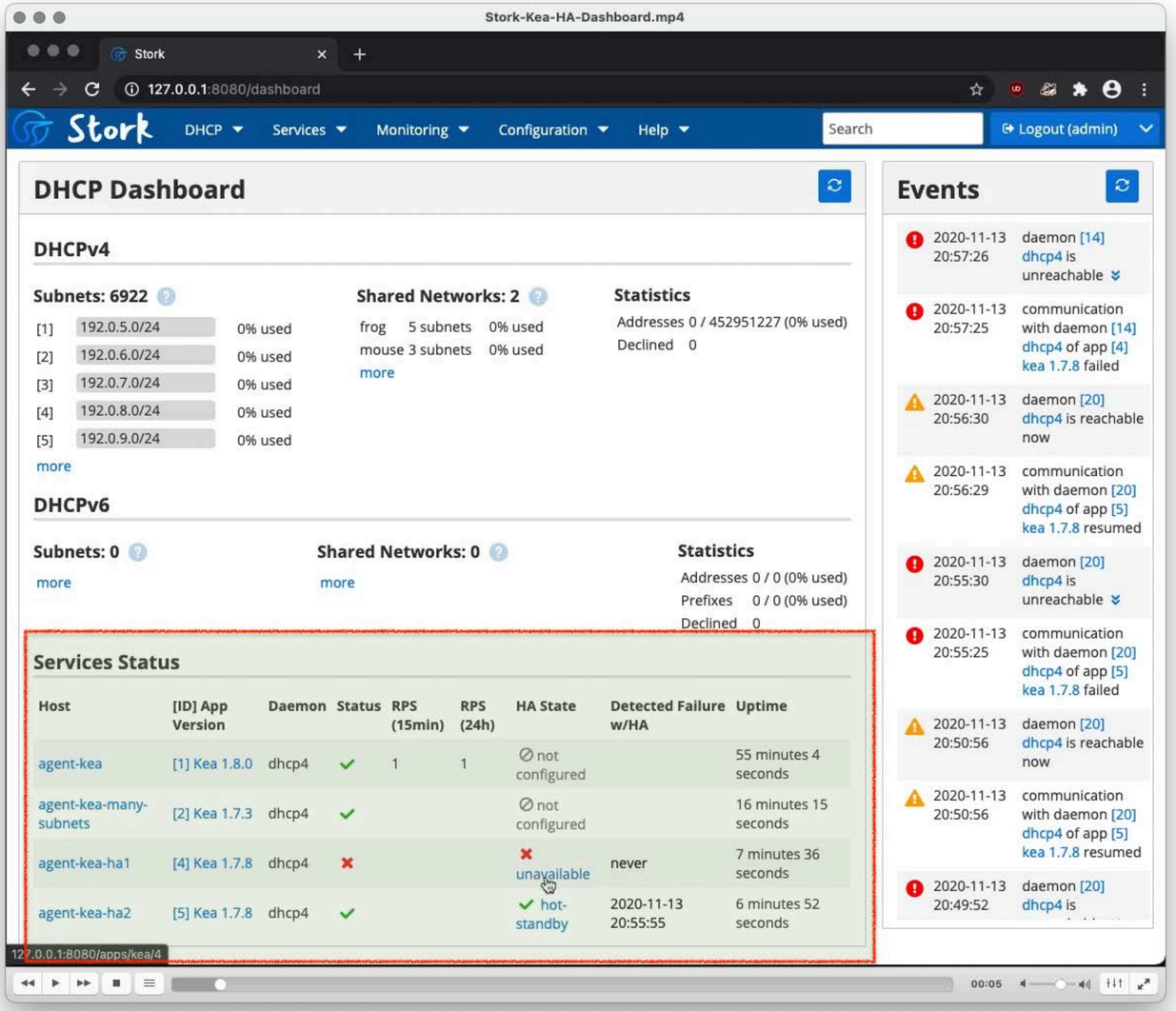
Monitoring Service Health



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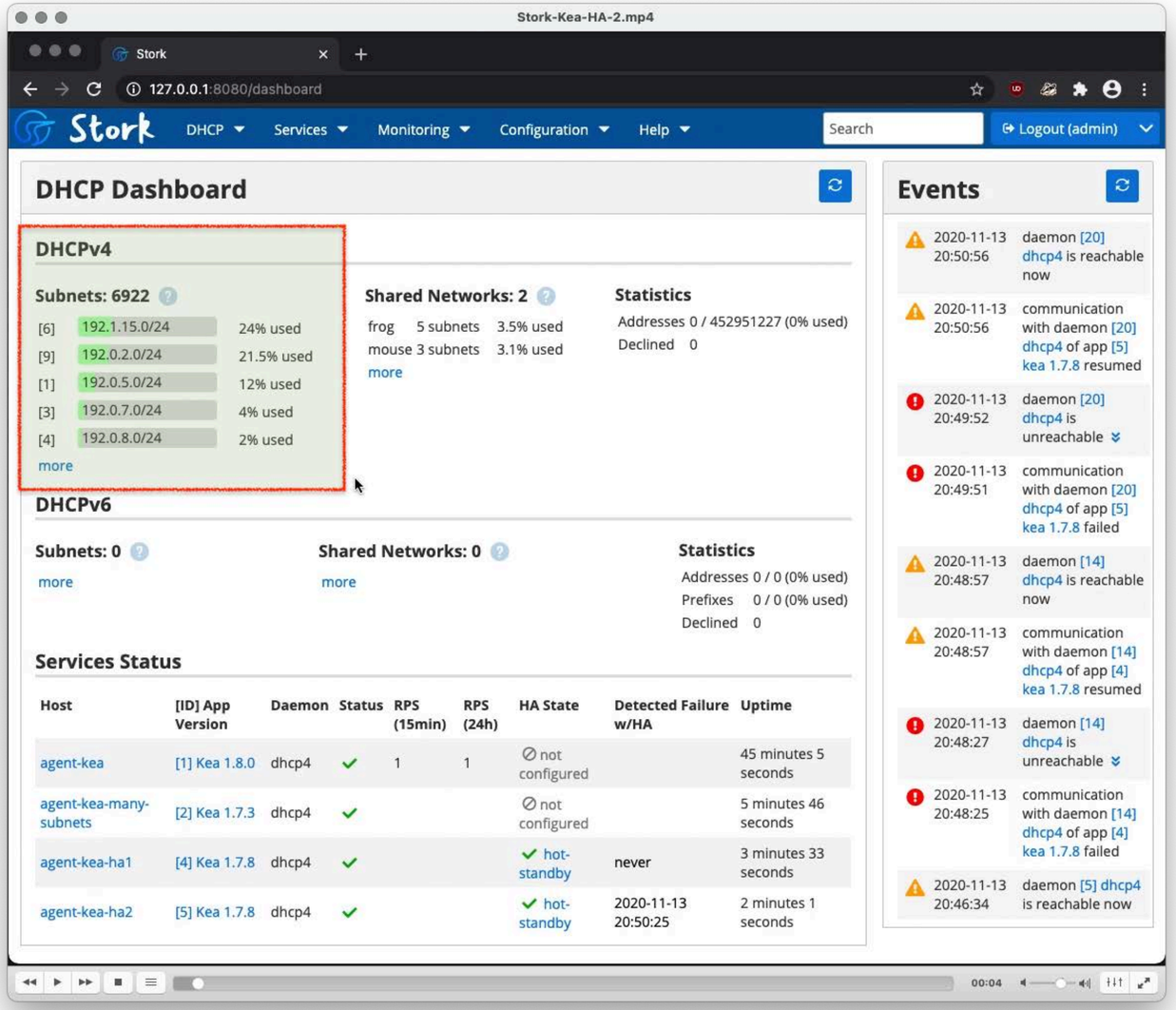
Pool Utilization



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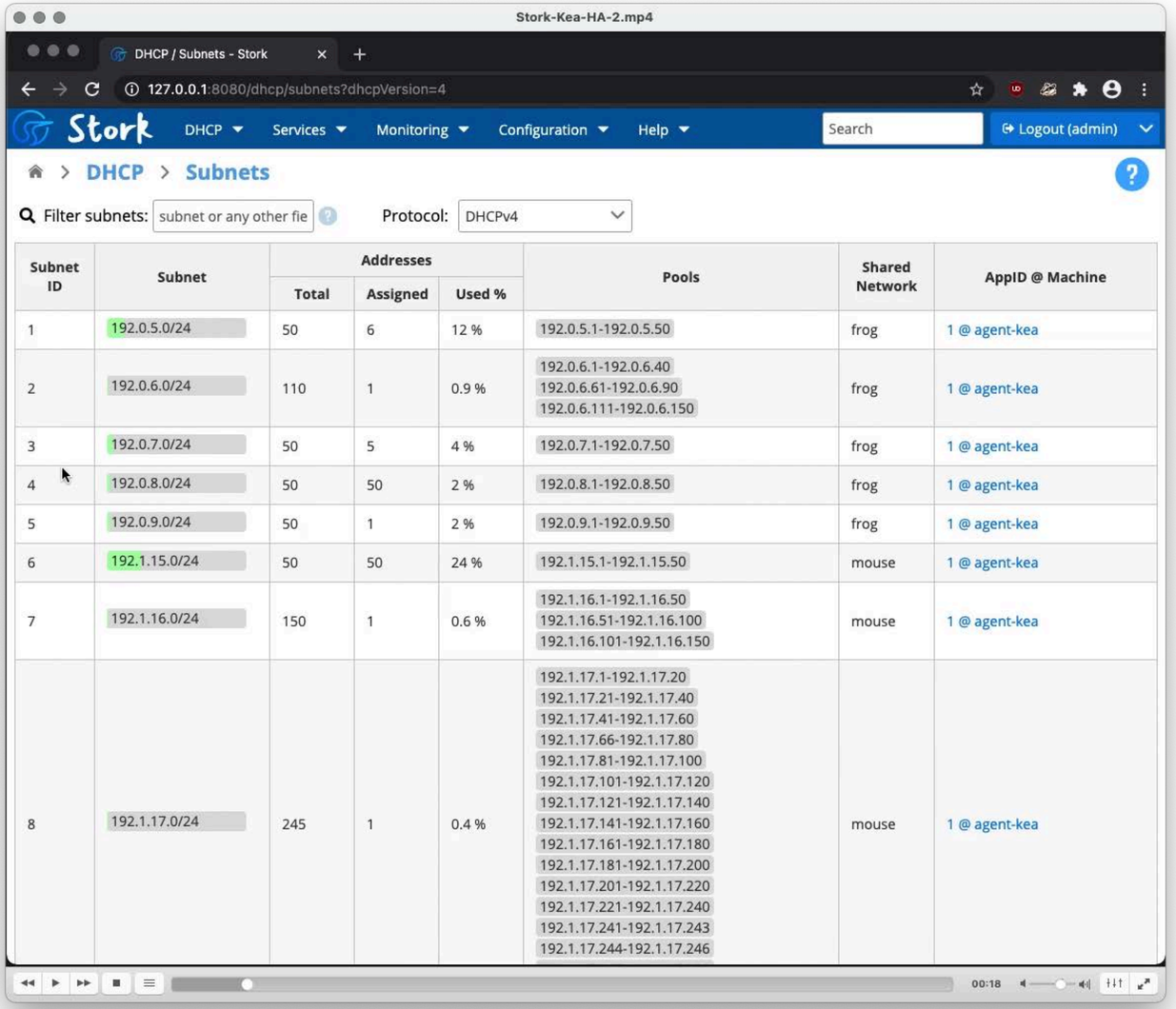
Pool Utilization



Subnet ID	Subnet	Addresses			Pools	Shared Network	AppID @ Machine
		Total	Assigned	Used %			
1	192.0.5.0/24	50	6	12 %	192.0.5.1-192.0.5.50	frog	1 @ agent-kea
2	192.0.6.0/24	110	1	0.9 %	192.0.6.1-192.0.6.40 192.0.6.61-192.0.6.90 192.0.6.111-192.0.6.150	frog	1 @ agent-kea
3	192.0.7.0/24	50	5	4 %	192.0.7.1-192.0.7.50	frog	1 @ agent-kea
4	192.0.8.0/24	50	50	2 %	192.0.8.1-192.0.8.50	frog	1 @ agent-kea
5	192.0.9.0/24	50	1	2 %	192.0.9.1-192.0.9.50	frog	1 @ agent-kea
6	192.1.15.0/24	50	50	24 %	192.1.15.1-192.1.15.50	mouse	1 @ agent-kea
7	192.1.16.0/24	150	1	0.6 %	192.1.16.1-192.1.16.50 192.1.16.51-192.1.16.100 192.1.16.101-192.1.16.150	mouse	1 @ agent-kea
8	192.1.17.0/24	245	1	0.4 %	192.1.17.1-192.1.17.20 192.1.17.21-192.1.17.40 192.1.17.41-192.1.17.60 192.1.17.66-192.1.17.80 192.1.17.81-192.1.17.100 192.1.17.101-192.1.17.120 192.1.17.121-192.1.17.140 192.1.17.141-192.1.17.160 192.1.17.161-192.1.17.180 192.1.17.181-192.1.17.200 192.1.17.201-192.1.17.220 192.1.17.221-192.1.17.240 192.1.17.241-192.1.17.243 192.1.17.244-192.1.17.246	mouse	1 @ agent-kea

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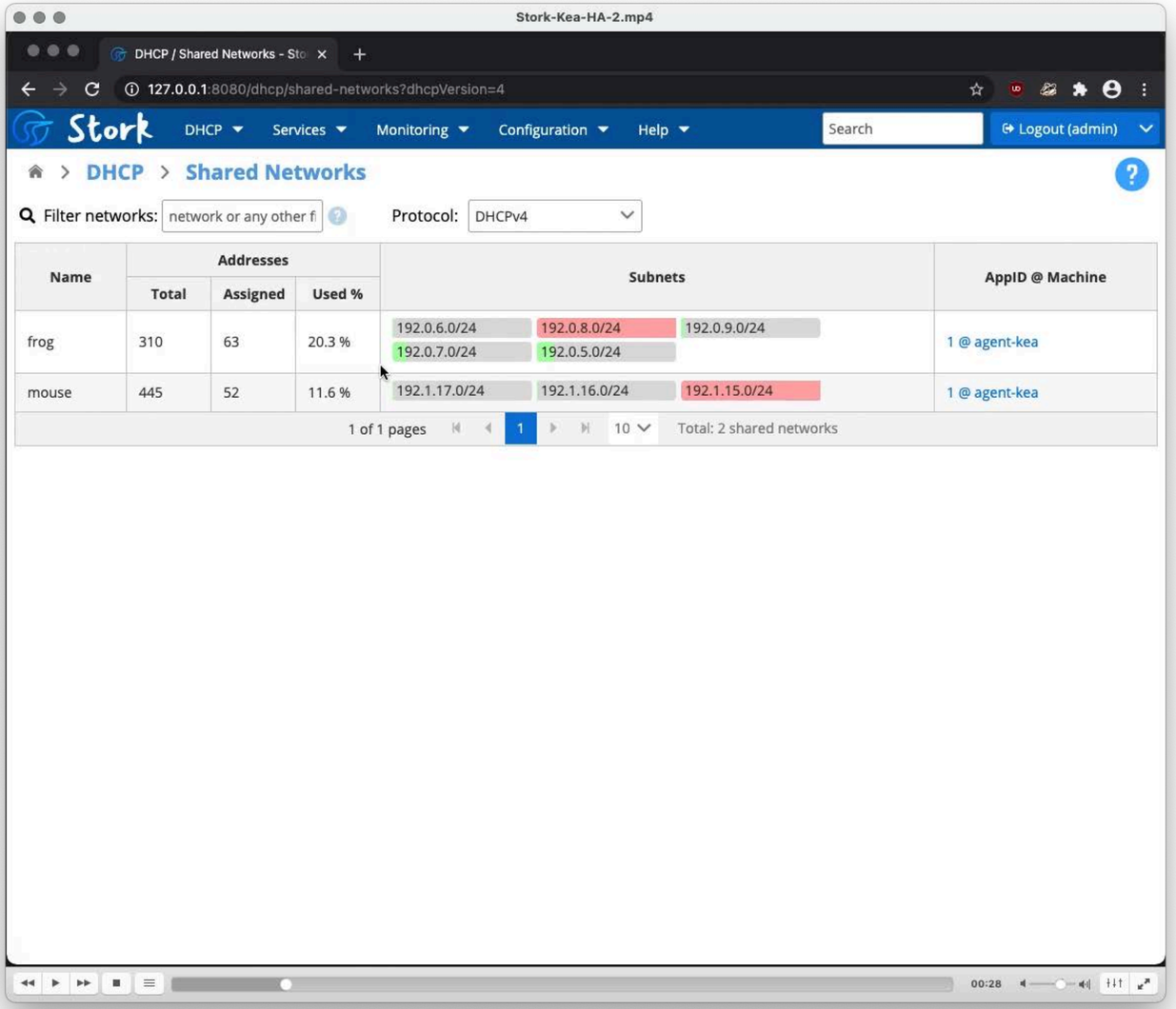
Pool Utilization



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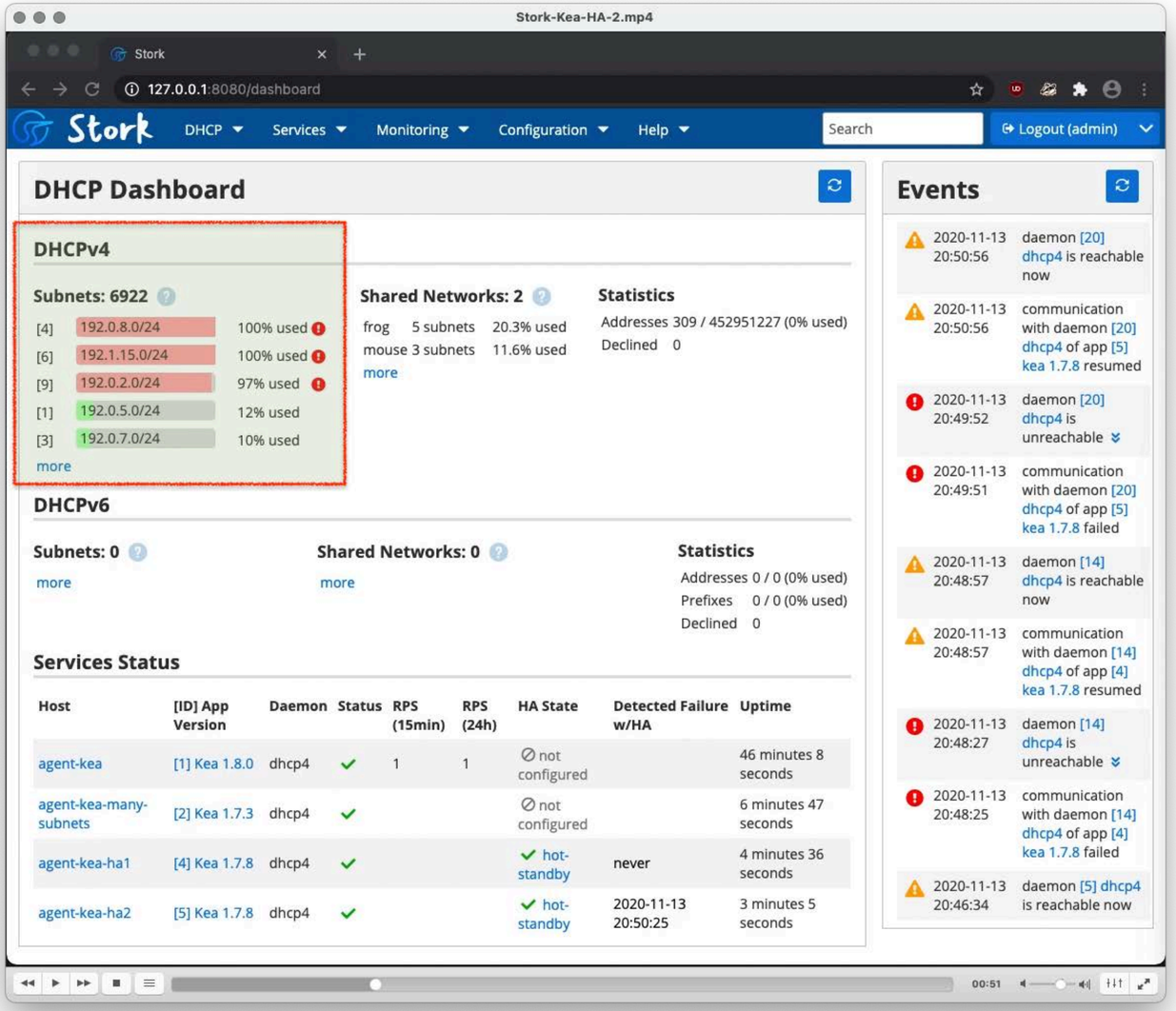
Pool Utilization



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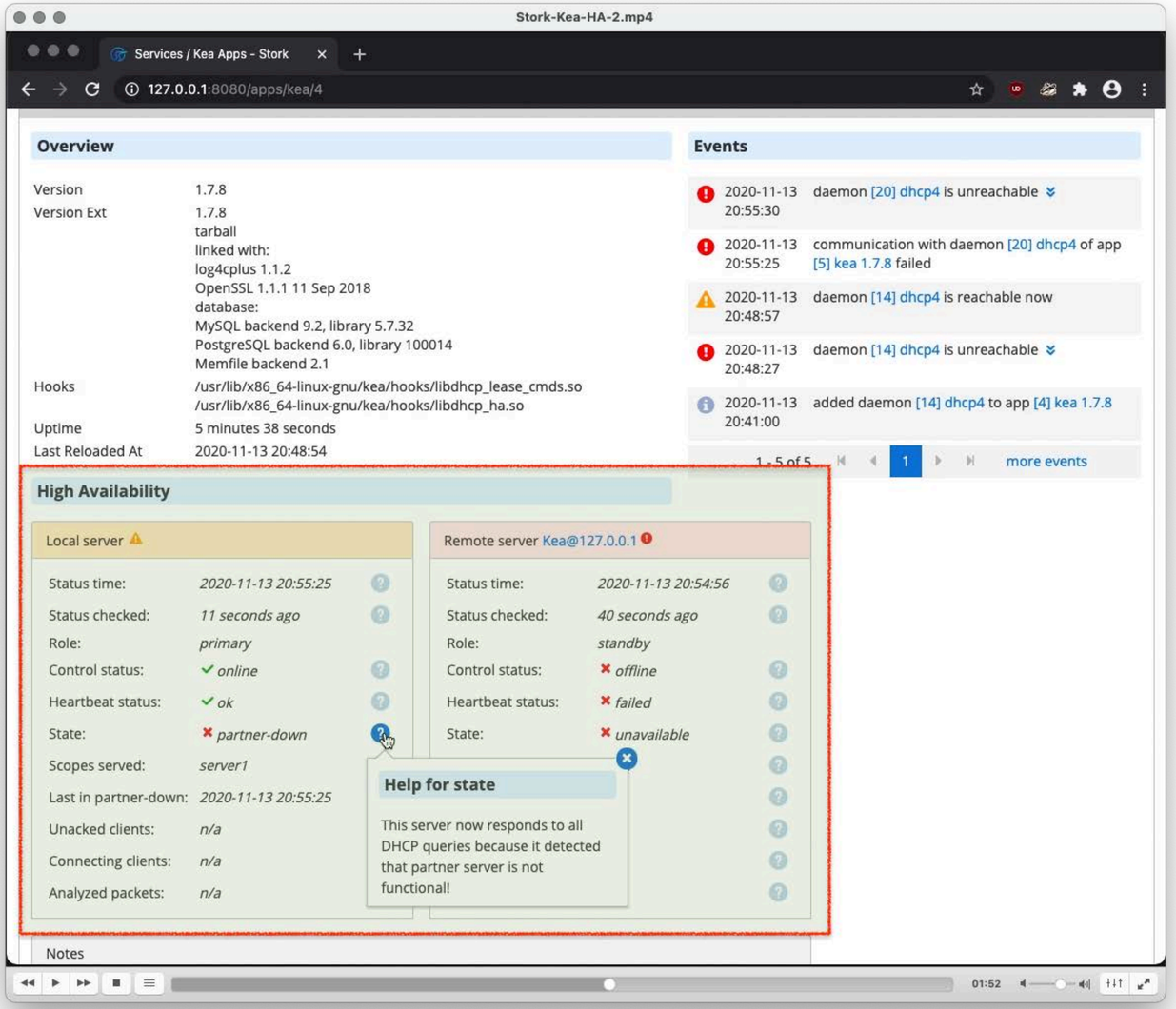
HA-Health Status



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Stork REST API

- Like all parts of Kea, Stork has an extensive REST/JSON API to automate management
  - add/delete machines
  - manage users
  - fetch log files
  - fetch events
  - get reservations
  - get DHCP statistics on subnets

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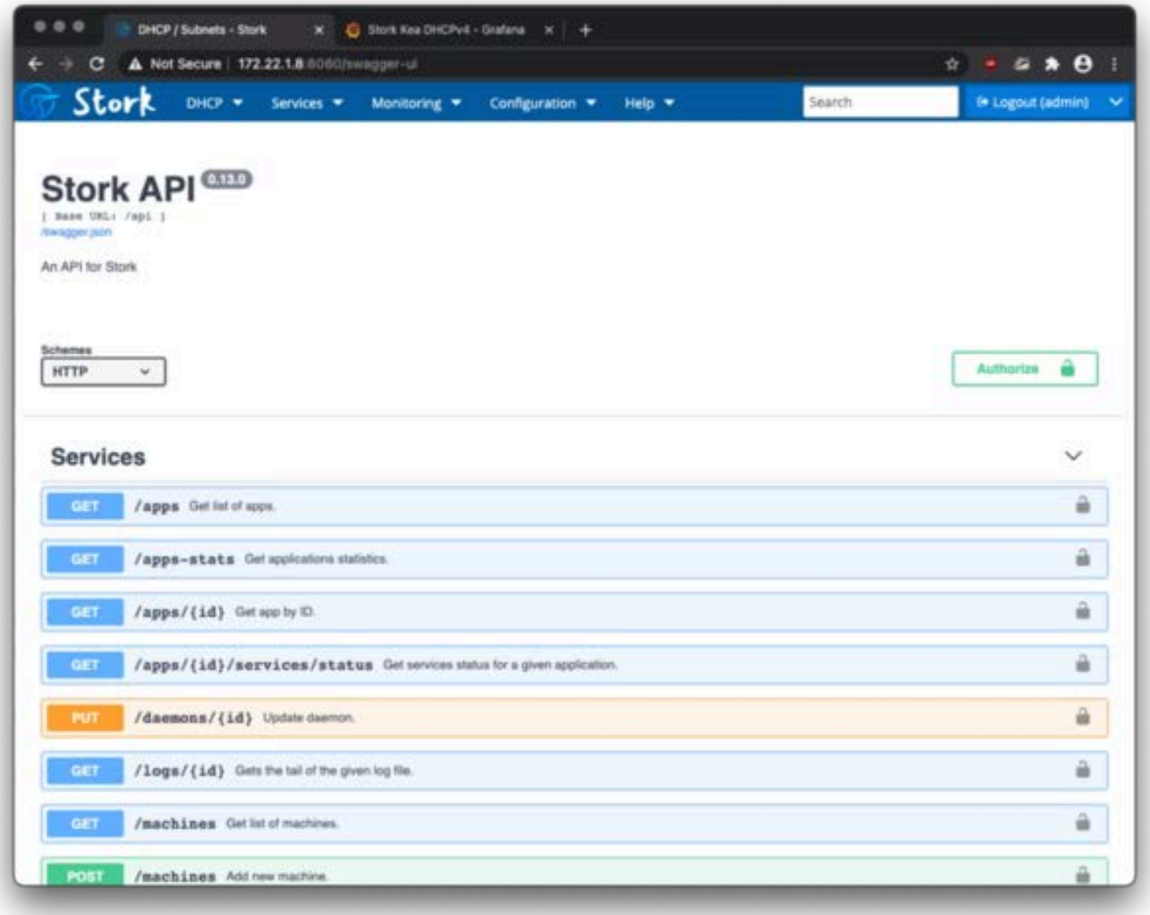
Stork REST API

- The API documentation can be found in the **Help** menue



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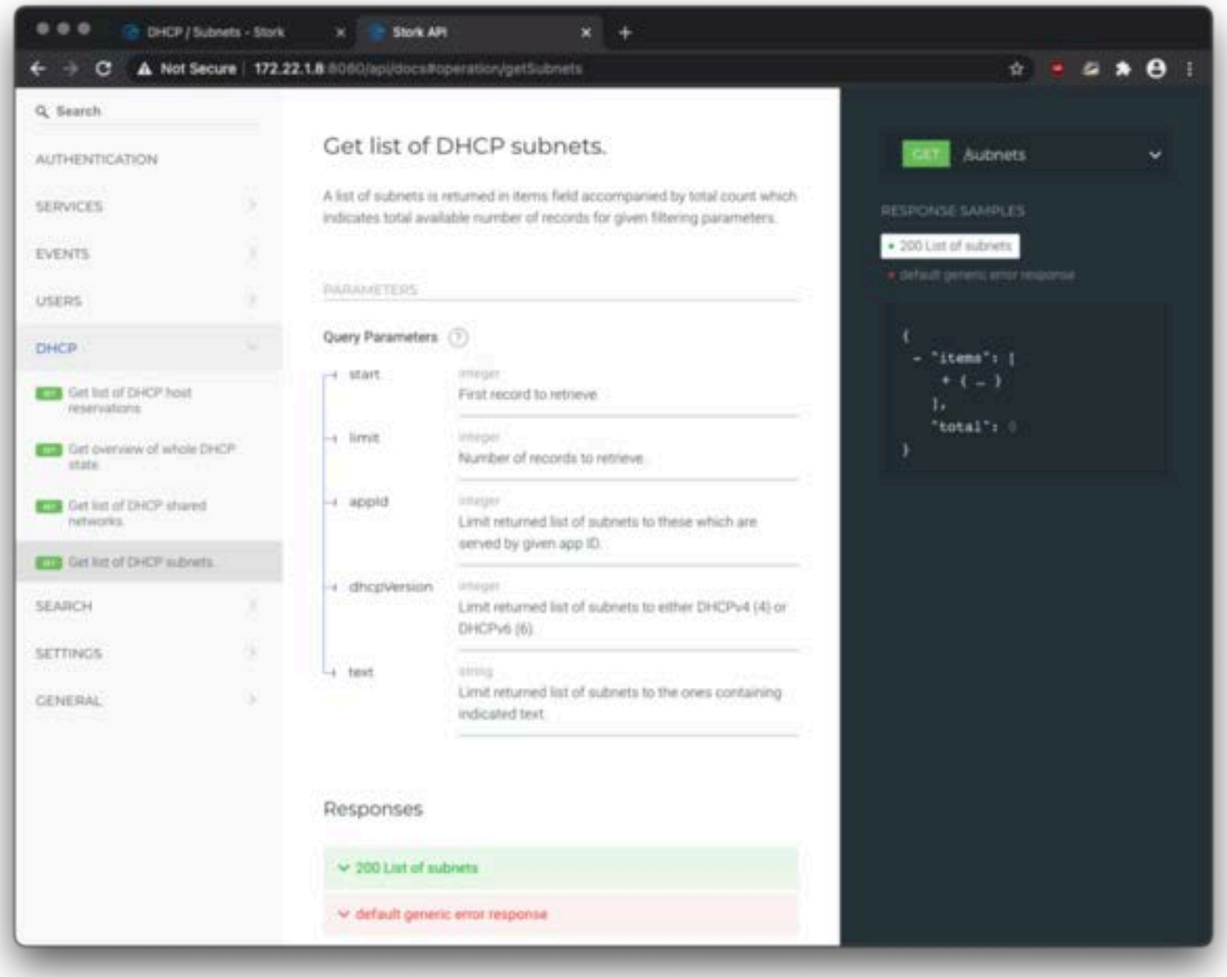
Stork REST API

- The API documentation can be found in the **Help** menue



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Other Monitoring

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Leases from a memfile

- Mike Miller has created two shell scripts that list the DHCPv4 and DHCPv6 leases from a memfile database
- Homepage:

  `https://archive.mgm51.com/sources/kea-scripts.html`

```
% kea-show-leases4.sh
IPAddr          HWAddr              Lease Start           Renew           Expire          Hostname  State
10.20.2.7       z0:z1:d9:z5:7c:36   14400 20150905T113158 20150905T133158 20150905T153158 host1.    0
10.20.2.6       0z:1z:d9:z5:7c:35   14400 20150905T112931 20150905T132931 20150905T152931 .         0
10.20.2.234     zz:75:0z:1a:a0:98   14400 20150905T112029 20150905T132029 20150905T152029 .         0
172.20.2.222    az:z3:cz:c4:4b:00   14400 20150905T110758 20150905T130758 20150905T150758 .         0
```

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Leases from a SQL database

- The presenter of this webinar has created a simple python3 script that lists the leases from a PostgreSQL Kea lease database
- Source:

  `https://git.sr.ht/~cstrotm/kea-list-leases`

```
% kea-list-leases.py
DHCPv4 leases:  6
IP Address    | Hostname         | HW Addr           | Client-ID                | Subnet ID | lifetime | expire
192.0.2.23    | macbookair       | 14:c2:33:fd:ba:fb | 01:14:c2:33:fd:ba:fb | 1         | 14400    | 2020-11-18T14:11:17+01:00
192.0.2.80    | phone            | 00:02:13:55:5e:23 |                          | 1         | 14400    | 2020-11-18T14:33:32+01:00
192.0.2.120   | linux-fedora     | 3c:09:14:7a:6a:67 | 01:3c:09:14:7a:6a:67 | 1         | 14400    | 2020-11-18T13:24:08+01:00
192.0.2.121   |                  | 80:47:23:e6:38:32 |                          | 1         | 14400    | 2020-11-18T14:48:28+01:00
192.0.2.122   | openbsd          | a8:61:b6:d1:ee:6e | 01:a8:61:b6:d1:ee:6e | 1         | 14400    | 2020-11-18T14:48:42+01:00
192.0.2.242   | nas              | 00:12:47:30:c4:de | 01:00:12:47:30:b4:de | 1         | 14400    | 2020-11-18T14:47:31+01:00
```

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Process Monitoring - keactrl

- on the local machine, the command keactrl can be used to check the status of the Kea processes

```
$ keactrl status
DHCPv4 server: active
DHCPv6 server: inactive
DHCP DDNS: active
Control Agent: active
Netconf agent: inactive
Kea configuration file: /usr/local/etc/kea/kea.conf
Kea DHCPv4 configuration file: /usr/local/etc/kea/kea-dhcp4.conf
Kea DHCPv6 configuration file: /usr/local/etc/kea/kea-dhcp6.conf
Kea DHCP DDNS configuration file: /usr/local/etc/kea/kea-dhcp-ddns.conf
Kea Control Agent configuration file: /usr/local/etc/kea/kea-ctrl-agent.conf
Kea Netconf configuration file: /usr/local/etc/kea/kea-netconf.conf
keactrl configuration file: /usr/local/etc/kea/keactrl.conf
```

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Process Monitoring - systemd

- On a Linux machine with systemd, the status of the Kea processes can by read from the systemd process

```
# systemctl status kea-dhcp6
● kea-dhcp6.service - Kea DHCPv6 Service
     Loaded: loaded (/etc/systemd/system/kea-dhcp6.service; enabled; vendor preset: disabled)
     Active: active (running) since Thu 2020-11-12 22:50:14 CET; 1 day 10h ago
       Docs: man:kea-dhcp6(8)
   Main PID: 244200 (kea-dhcp6)
      Tasks: 1 (limit: 11784)
     Memory: 5.6M
        CPU: 22.572s
     CGroup: /system.slice/kea-dhcp6.service
             └─244200 /opt/kea/sbin/kea-dhcp6 -c /opt/kea/etc/kea/kea-dhcp6.conf

Nov 12 22:50:14 home01 systemd[1]: Started Kea DHCPv6 Service.
Nov 12 22:50:14 home01 kea-dhcp6[244200]: 2020-11-12 22:50:14.813 INFO  [kea-dhcp6.dhcp6/244200.140267216668800] DHCP6_STARTING Kea DHCPv6 server
version 1.9.1
```

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Process Monitoring via Systemd API

- systemd exposes the state of managed services via the DBUS API
  - a monitoring system can read the DBUS API information
  - Example: Monitoring systemd services in realtime with Chronograf

    `https://devconnected.com/monitoring-systemd-services-in-realtime-with-chronograf/`
  - Example: Prometheus exporter for systemd services

    `https://github.com/povilasv/systemd_exporter`

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Monitoring via Kea API

- Kea exposes a REST/JSON API
  - This API can be used to monitor the health and function of the Kea services (independent from Stork)
  - Python Kea exporter for Prometheus

    `https://pypi.org/project/kea-exporter/`
  - Source code of the Prometheus Kea exporter:

    `https://github.com/mweinelt/kea-exporter`

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DHCP Function Monitoring

- dhcping is a simple tool to test if a DHCP server responds to DHCP requests and returns a lease
  - it requests a lease (DHCPREQUEST) or DHCP option information (DHCPINFORM) from a DHCP Server
  - after obtaining a lease, it will release the lease immediately
  - Original Homepage:

    `http://www.mavetju.org/unix/general.php`
  - Updated source:

    `https://github.com/nean-and-i/dhcping`

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DHCping

```
% sudo ./dhcping -v -s 192.0.2.1 -h 01:02:03:04:05:05 -c 192.0.2.145

--------------------------------------------------------------------------------

DHCP REQUEST
packet 250 bytes

nop: 1
htype: 1
hlen: 6
hops: 0
xid: ef0aaf5f
secs: 0
flags: 0
ciaddr: 192.0.2.145
yiaddr: 0.0.0.0
siaddr: 0.0.0.0
giaddr: 0.0.0.0
chaddr: 01:02:03:04:05:05
sname :
fname :
option 53 DHCP message type
   DHCP message type: 3 (DHCPREQUEST)
option 50 Request IP address
   Requested IP address: 192.0.2.145
```

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DHCping

```
Got answer from: 192.0.2.1
packet 300 bytes

nop: 2
htype: 1
hlen: 6
hops: 0
xid: ef0aaf5f
secs: 0
flags: 7f80
ciaddr: no entry found
yiaddr: 0.0.0.0
siaddr: 0.0.0.0
giaddr: 0.0.0.0
chaddr: 01:02:03:04:05:05
sname :
fname :
option 53 DHCP message type
   DHCP message type: 6 (DHCPNAK)
option 54 DHCP Server identifier
   Server identifier: 192.0.2.1
option 56 Message
```

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DHCping

```
DHCP RELEASE
packet 250 bytes

nop: 1
htype: 1
hlen: 6
hops: 0
xid: ef0aaf5f
secs: 0
flags: 0
ciaddr: 192.0.2.145
yiaddr: 0.0.0.0
siaddr: 0.0.0.0
giaddr: 0.0.0.0
chaddr: 01:02:03:04:05:05
sname :
fname :
option 53 DHCP message type
   DHCP message type: 7 (DHCPRELEASE)
option 54 DHCP Server identifier
   Server identifier: 192.0.2.1
```

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DHCPtest

- another DHCP test tool
  - written in D

```
% ./dhcptest --query
dhcptest v0.7 - Created by Vladimir Panteleev
https://github.com/CyberShadow/dhcptest
Run with --help for a list of command-line options.

Listening for DHCP replies on port 68.
Sending packet:
  op=BOOTREQUEST chaddr=2E:78:71:CA:DA:26 hops=0 xid=8DDD0A71 secs=0 flags=8000
  ciaddr=0.0.0.0 yiaddr=0.0.0.0 siaddr=0.0.0.0 giaddr=0.0.0.0 sname= file=
  1 options:
     53 (DHCP Message Type): discover
Received packet from 192.0.2.8:67:
  op=BOOTREPLY chaddr=2E:78:71:CA:DA:26 hops=0 xid=8DDD0A71 secs=0 flags=8000
  ciaddr=0.0.0.0 yiaddr=192.0.2.115 siaddr=0.0.0.0 giaddr=0.0.0.0 sname= file=
  9 options:
     53 (DHCP Message Type): offer
      1 (Subnet Mask): 255.255.255.0
      3 (Router Option): 192.0.2.1
      6 (Domain Name Server Option): 192.0.2.8, 172.16.1.105
     15 (Domain Name): home.example.com
     51 (IP Address Lease Time): 14400 (4 hours)
     54 (Server Identifier): 192.0.2.8
     58 (Renewal (T1) Time Value): 3600 (1 hour)
     59 (Rebinding (T2) Time Value): 7200 (2 hours)
```

- Source:

  `https://github.com/CyberShadow/dhcptest`

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Monitoring for Pool depletion

- Performance suffers at very high pool utilization, because Kea is checking every address in order to see if it is available
- If an DHCP pool runs full, there is a risk that DHCP clients will not get an IP address lease and cannot join the network

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How to deal with pool depletion

- if you encounter address pool depletion, check for the reasons
  - lease time too high for the number of DHCP clients in the network
  - machines are not releasing their lease on shutdown
  - malicious/buggy DHCP client software

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Countermeasures to address pool depletion

- configure the Microsoft DHCP clients to release their leases on shutdown
  - can be done via DHCP option:
    `https://docs.microsoft.com/en-us/openspecs/windows_protocols/ms-dhcpe/4cde5ceb-4fc1-4f9a-82e9-13f6b38d930c`
  - useful in public places where clients are not coming back
- consider switching to IPv6
  - make the pool as large as the current IPv4 Internet ;)

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Logging

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Kea logging configuration

- All Kea services provide flexible logging:
  `https://kea.readthedocs.io/en/latest/arm/logging.html`
- Log output can be written to one or more targets
  - to syslog
  - to a file
  - to stdout or stderr

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Kea logging configuration

- Example: Logging to stdout and into a file

```
"loggers": [{
    "name": "kea-dhcp4",
    "output_options": [
        {
            "output": "stdout",
            "pattern": "%-5p %m\n"
        },{
            "output": "/var/log/kea/kea-dhcp4.log",
            "maxsize": 1048576,
            "maxver": 10
        }
    ],
    "severity": "INFO",
    "debuglevel": 0
}]
[...]
```

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Kea Logger

- The Kea Log-Messages are sent from different logging modules
  - the logging modules create a logging hierarchy
    - The Root-Logger is named after the Kea service process
    - Below the Root-Logger are one or more logging modules that can be used to sent specific logging information to other log-targets, or change other logging parameters such as the severity
- a list of Loggers supported by Kea servers and hook-libraries can be found in the Kea documentation

`https://kea.readthedocs.io/en/latest/arm/logging.html#the-name-string-logger`

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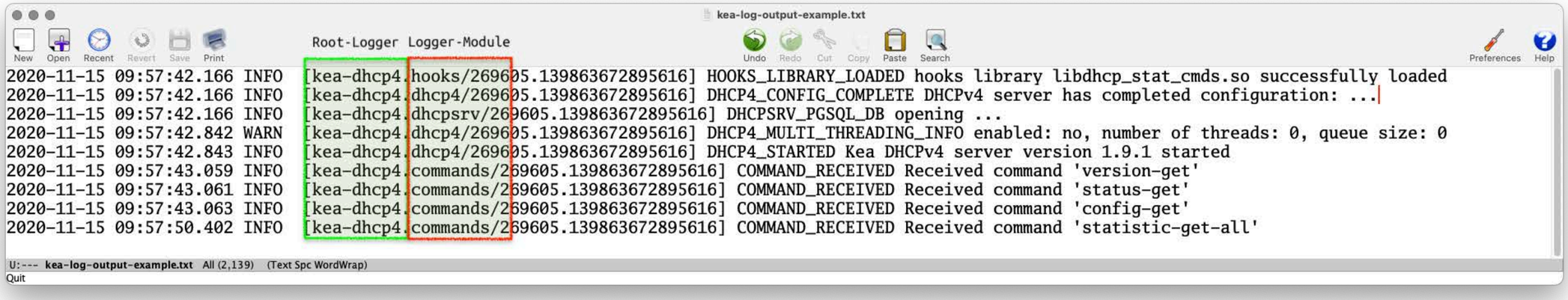
Kea Logger

- The name of the logging module that created a log message can be found in the log output (when using the default log pattern for files)



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Logging to syslog

- Using the output parameter of syslog will sent the log messages of the chosen logger to the syslog daemon
- If a different service name should be used for the syslog messages, the service name can be specified in the format `syslog:name`

```
[...]
    "loggers": [{
        "name": "kea-dhcp4",
        "output_options": [
            { "output": "syslog:dhcp4" }
        ],
        "severity": "WARN", "debuglevel": 0
    }]
[...]
```

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Logging to a file

- When logging to a file, the parameter output specifies the file name
  - file rollover can be specified with the **maxsize** (size of log-file in bytes) and **maxver** (number of log-file generations)

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Logging Message Format

- The content of the log messages can be controlled with the `pattern` option
  - The pattern used for each message is described by a string containing one or more format components as part of a text string
  - In addition to the components the string may contain any other arbitrary text you find useful.
  - The Log4Cplus documentation provides information on the pattern format string:

    `https://log4cplus.sourceforge.io/`

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Logging Message Format

- Example: the pattern definition below …

```
{
    "output": "....",
    "pattern": "%D{%Y-%m-%d %H:%M:%S.%q} %-5p [%c/%i.%t] %m\n"
},
```

- … will create a log entry similar to this one:

```
2019-08-05 14:27:45.871 DEBUG [kea-dhcp4.dhcpsrv/8475.12345] DHCPSRV_TIMERMGR_START_TIMER starting timer: reclaim-expired-leases
```

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Kea and Systemd Journal

- when a Kea service is running under control of systemd, the logging output written to stdout will be stored in the systemd journal

```
[...]
    "loggers": [{
        "name": "kea-dhcp4",
        "output_options": [
            {
                "output": "stdout",
                "pattern": "%-5p %m\n"
            }
        ],
        "severity": "INFO",
        "debuglevel": 0
    }]
[...]
```

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Kea and Systemd Journal

- Systemd-Journal entries can be queried with a filter language
  - easier than filtering through log files (if you don't know awk and perl)
  - systemd-journald data can be sent via an encrypted and authenticated connection to a central systemd-journald log host
  - see the journalctl documentation for details

```
# journalctl --since today -u kea-dhcp4 --grep DHCP4_LEASE_ADVERT
-- Logs begin at Fri 2020-09-18 11:20:45 CEST, end at Sat 2020-11-14 09:24:50 CET. --
Nov 14 00:00:00 home01 kea-dhcp4[244218]: INFO  DHCP4_LEASE_ADVERT [hwtype=1 00:0d:93:29:2d:30], cid=[01:00:0d:93:29:2d:30], tid=0xfa7d9468: lease 192.0.2.114 will be a>
Nov 14 00:00:04 home01 kea-dhcp4[244218]: INFO  DHCP4_LEASE_ADVERT [hwtype=1 00:0d:93:29:2d:30], cid=[01:00:0d:93:29:2d:30], tid=0xe998dcab: lease 192.0.2.114 will be a>
Nov 14 00:05:13 home01 kea-dhcp4[244218]: INFO  DHCP4_LEASE_ADVERT [hwtype=1 2e:78:71:ca:da:26], cid=[no info], tid=0x8ddd0a71: lease 192.0.2.115 will be advertised
Nov 14 02:15:06 home01 kea-dhcp4[244218]: INFO  DHCP4_LEASE_ADVERT [hwtype=1 14:c2:13:ed:ba:fb], cid=[01:14:c2:13:ed:ba:fb], tid=0xda0e88bc: lease 192.0.2.23 will be ad>
Nov 14 04:16:09 home01 kea-dhcp4[244218]: INFO  DHCP4_LEASE_ADVERT [hwtype=1 14:c2:13:ed:ba:fb], cid=[01:14:c2:13:ed:ba:fb], tid=0xda0e88be: lease 192.0.2.23 will be ad>
Nov 14 06:01:03 home01 kea-dhcp4[244218]: INFO  DHCP4_LEASE_ADVERT [hwtype=1 14:c2:13:ed:ba:fb], cid=[01:14:c2:13:ed:ba:fb], tid=0xda0e88c0: lease 192.0.2.23 will be ad>
Nov 14 08:04:24 home01 kea-dhcp4[244218]: INFO  DHCP4_LEASE_ADVERT [hwtype=1 14:c2:13:ed:ba:fb], cid=[01:14:c2:13:ed:ba:fb], tid=0xda0e88c3: lease 192.0.2.23 will be ad>
```

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Kea API authorization logging

- Starting with Kea 1.9.1, it is possible to restrict the Kea API commands to authorized users
- the authorization information will be logged with the `kea-ctrl-agent.http logger:`

```
# ./kea-ctrl-agent -c simple.json
20.10.15 14:05:16.550 INFO  [kea-ctrl-agent.http/174909] HTTP_CLIENT_REQUEST_AUTHORIZED received HTTP request authorized for 'admin'
20.10.15 14:05:16.550 INFO  [kea-ctrl-agent.commands/174909] COMMAND_RECEIVED Received command 'list-commands'
```

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Debug-Logging

- Quick option: start KEA DHCP4 in debug mode from the command line. This will automatically enable the highest debugging level
  - On a busy server, this will create too much debug information (see next slide for an alternative)

```
[kea-server]# systemctl stop kea-dhcp4
[kea-server]# kea-dhcp4 -d -c /etc/kea/kea-dhcp4.conf
```

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Debug-Logging

- Alternative: enable debug logging on a specific logger only

```
"loggers": [{
    "name": "kea-dhcp4",
    "output_options": [
        { "output": "syslog:dhcp4" }
    ],
    "severity": "WARN", "debuglevel": 0
    },{
    "name": "kea-dhcp4.flex-id-hooks",
    "output_options": [ {
        "output": "/var/log/kea/kea-dhcp4-flex-id.log"
    } ],
    "severity": "DEBUG",
    "debuglevel": 55
} ]
[...]
```

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Performance testing

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Kea perfdhcp tool

- The Kea development team has published the performance measurement tool (called **perfdhcp**) that is used to do DHCP performance testing for Kea
- Documentation:

  `https://kea.readthedocs.io/en/latest/man/perfdhcp.8.html?highlight=perfdhcp`
- Usage examples:

  https://users.isc.org/~tomasz/perfdhcp/dhcp-perf-guide.html#perfdhcp-commandline-examples

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Next Webinars

- 2nd December - Kea DHCP - Migrating to Kea from ISC DHCP

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Resources

- Video: Stork Management Dashboard for Kea DHCP

  `https://www.youtube.com/watch?v=5aF9NBIKhqQ`
- Stork Documentation

  `https://kea.readthedocs.io/projects/Stork`
- Stork Project Page

  `https://gitlab.isc.org/isc-projects/stork`
- Stork mailing list

  `https://lists.isc.org/mailman/listinfo/stork-users`

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Questions and Answers

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