Kea Webinar

Monitoring, Logging and Stork

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https://www.isc.org

Welcome

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

About this Webinar

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

Stork Dashboard for Kea

Stork Dashboard for Kea

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

What is Stork?

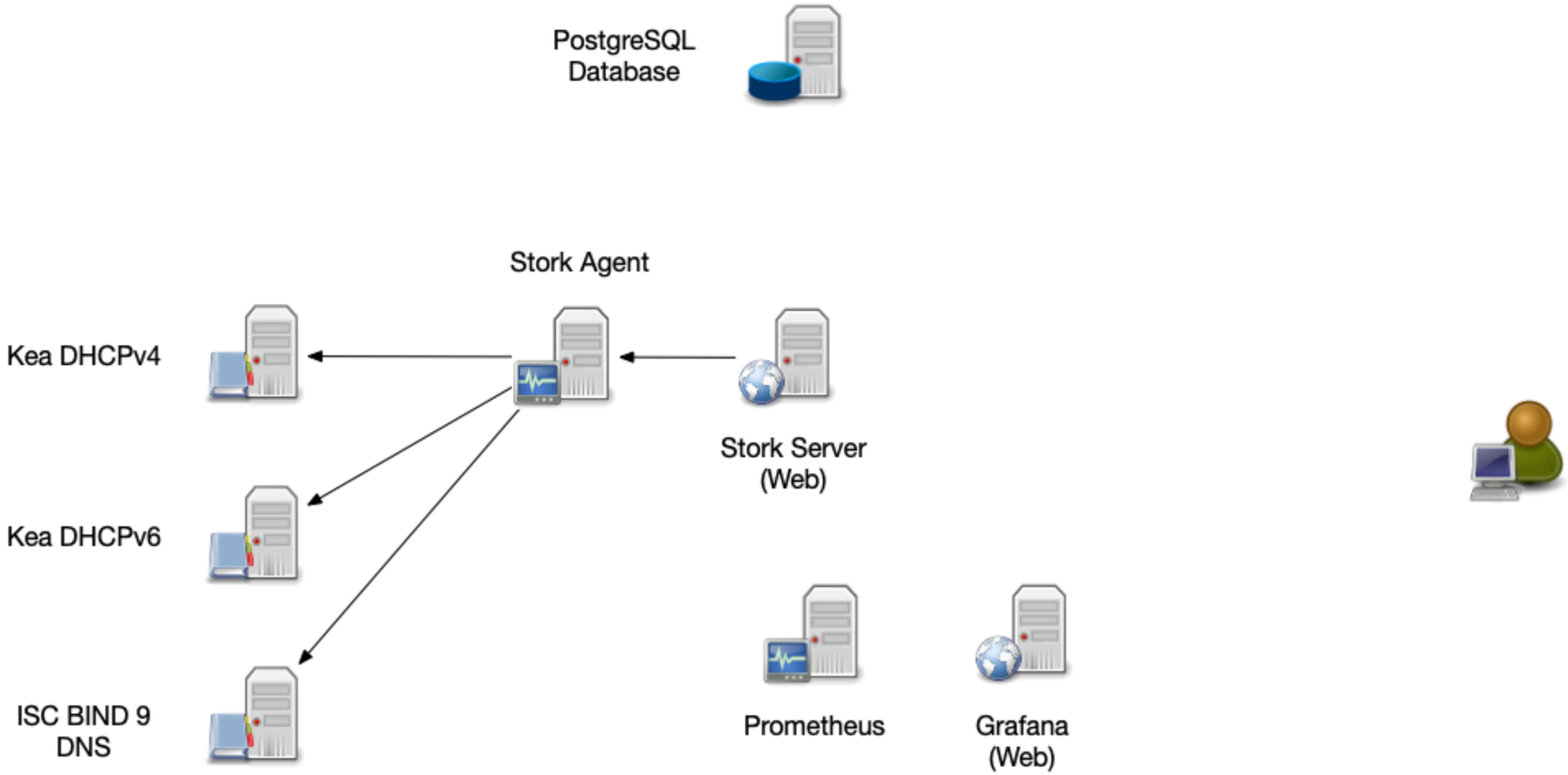
- It is under active development
  - monthly releases
  - it is usable and useful
  - but not feature complete (as of November 2020)
  - there are rough edges

Platforms

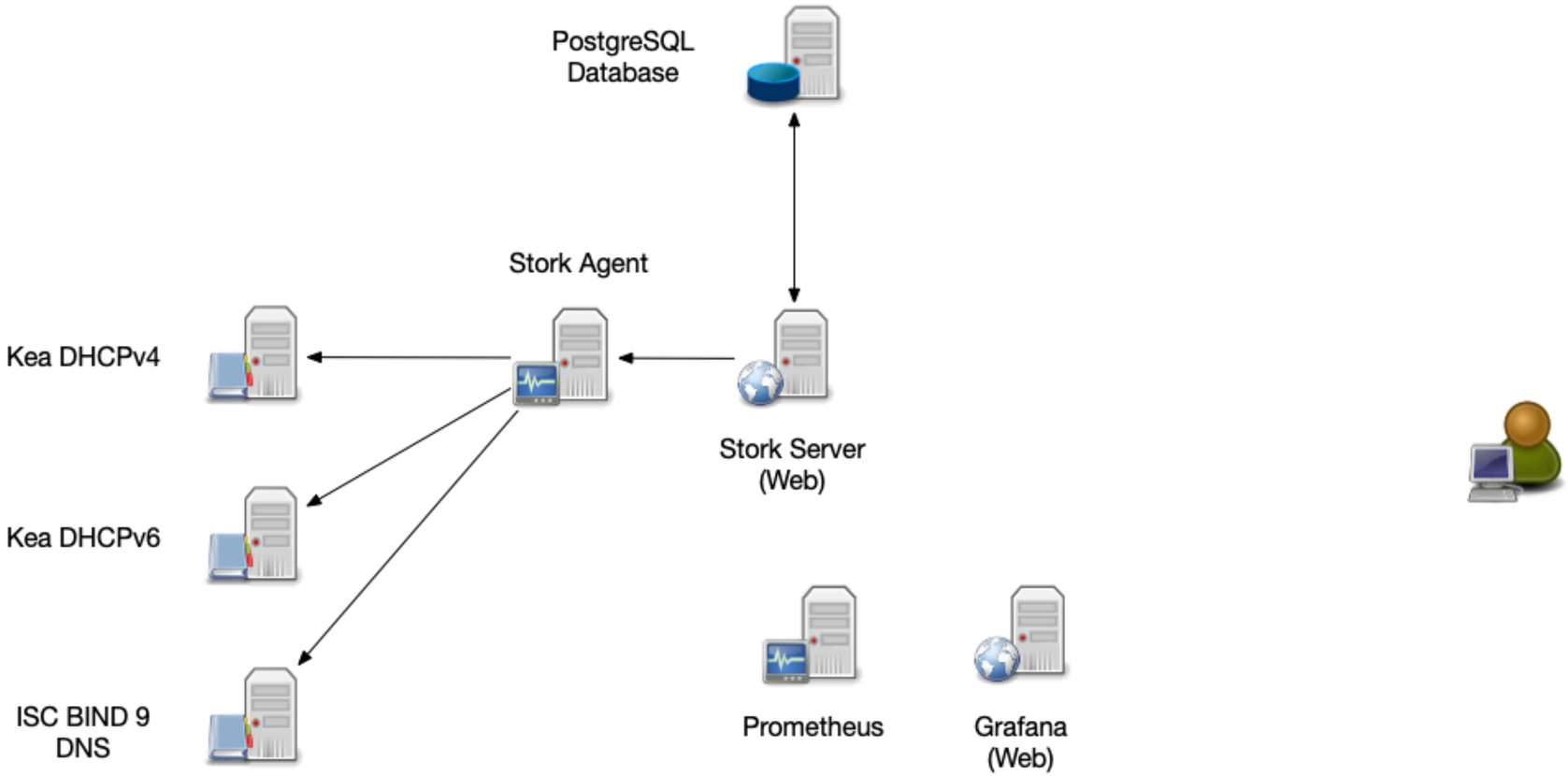
- Stork is available for
  - Ubuntu Linux (18.04 and 20.04)
  - Fedora Linux 31, 32 and 33
  - RedHat/CentOS 7/8
  - macOS*
- Stork might work on other Unix(ish) platforms
- Stork can run co-located with a Kea service, or can run on a dedicated machine

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

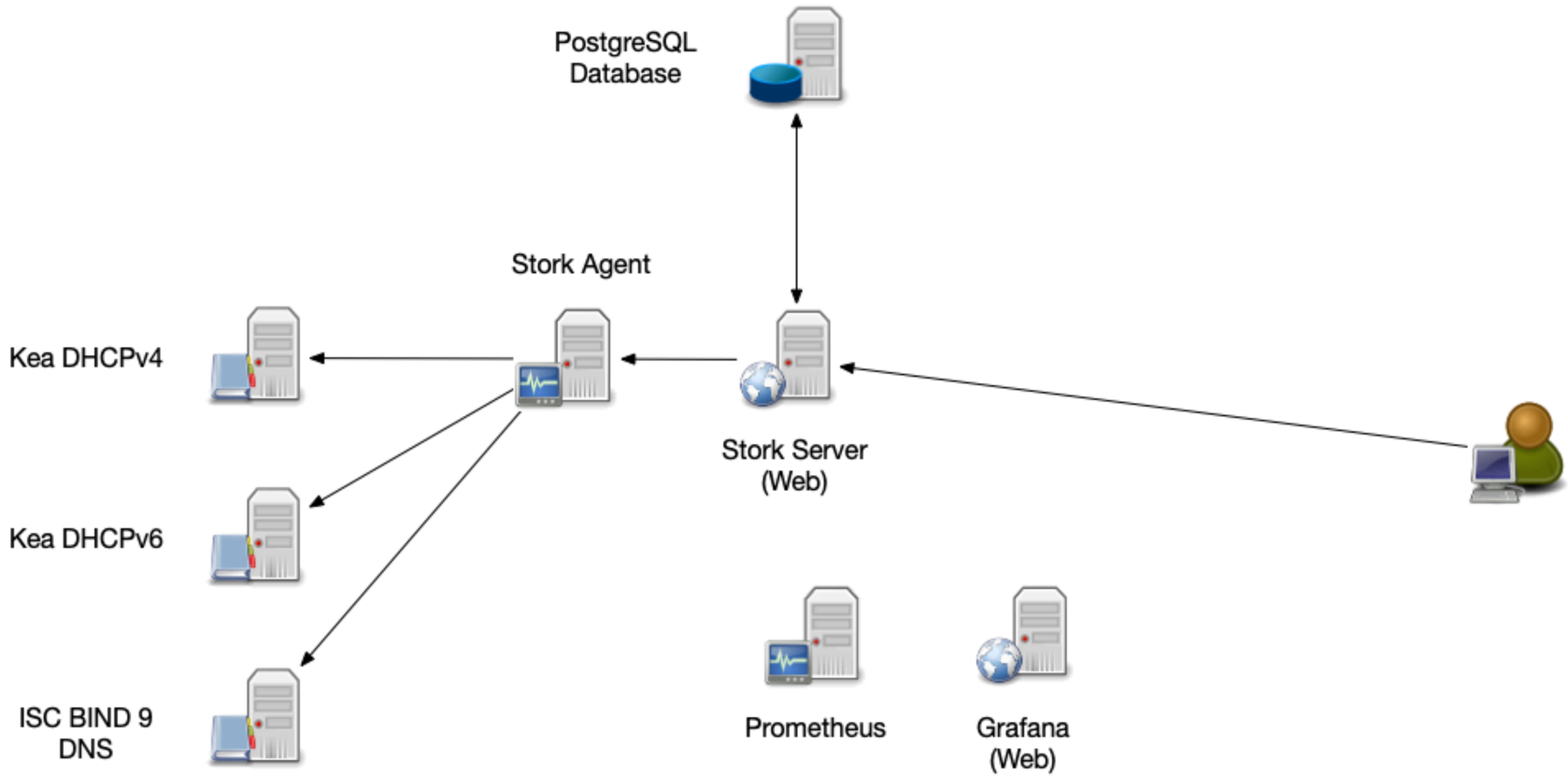
Architecture



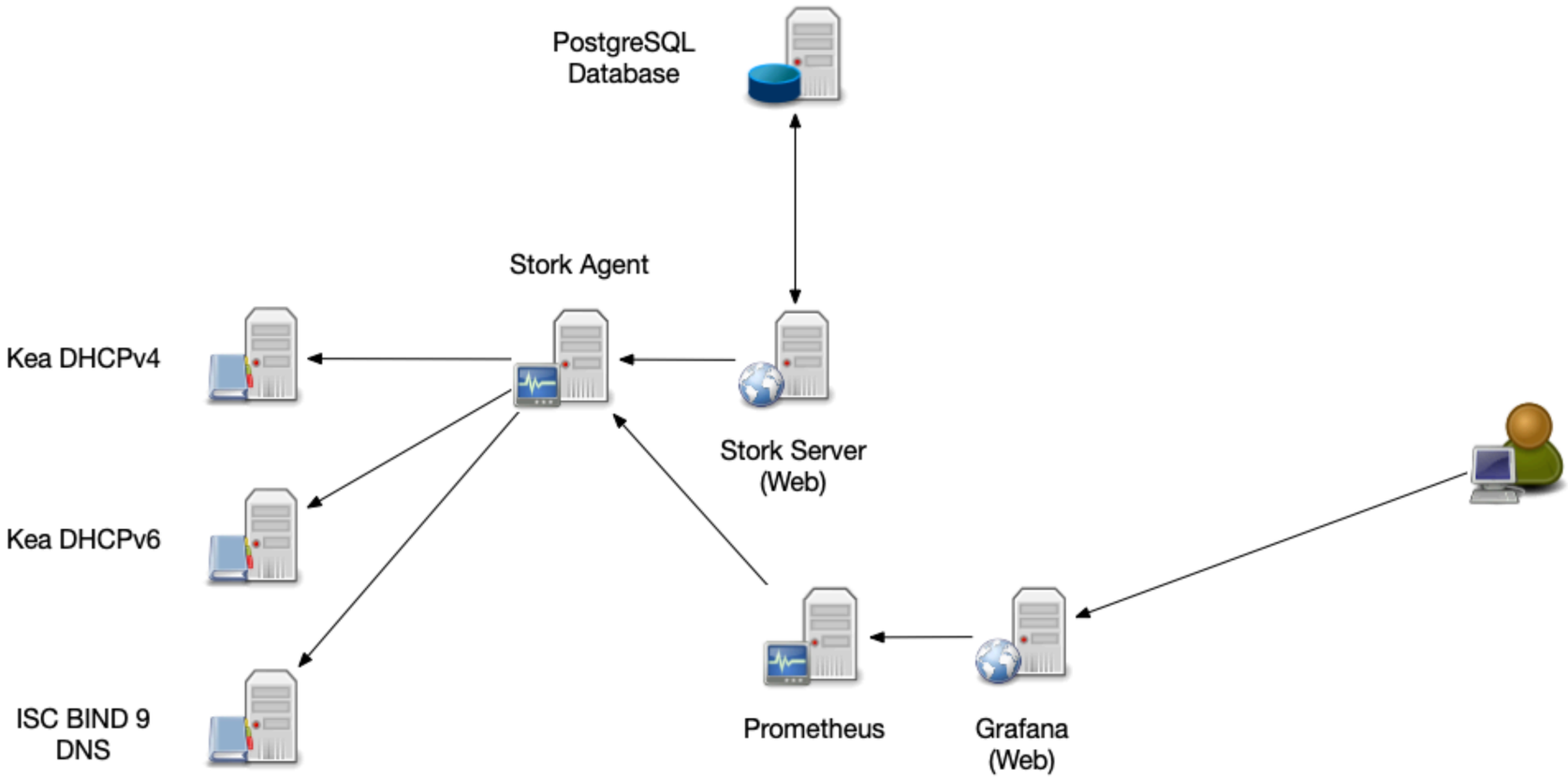
Architecture



Architecture



Architecture



Requirements

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

Installation (from packages)

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

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'
```

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
[...]
```

Installation on CentOS 8

- Install the Stork-Agent and -Server

```
# dnf install isc-stork-agent isc-stork-server
isc-stork                                                                                                           446  B/s | 473  B     00:01
isc-stork-noarch                                                                                                    700  B/s | 473  B     00:00
isc-stork-source                                                                                                    694  B/s | 473  B     00:00
Dependencies resolved.
=====================================================================================================================================================
 Package                                    Architecture                Version                                     Repository                  Size
=====================================================================================================================================================
Installing:
 isc-stork-agent                            x86_64                      0.13.0.201104144722-1                       isc-stork                  8.3 M
 isc-stork-server                           x86_64                      0.13.0.201104144722-1                       isc-stork                   23 M

Transaction Summary
=====================================================================================================================================================
Install  2 Packages

Total download size: 31 M
Installed size: 68 M
Is this ok [y/N]:
```

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).

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]:
```

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
```

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]:
```

PostgreSQL

- Initialize the database

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

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.
```

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
```

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

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
```

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
```

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

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
```

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"
```

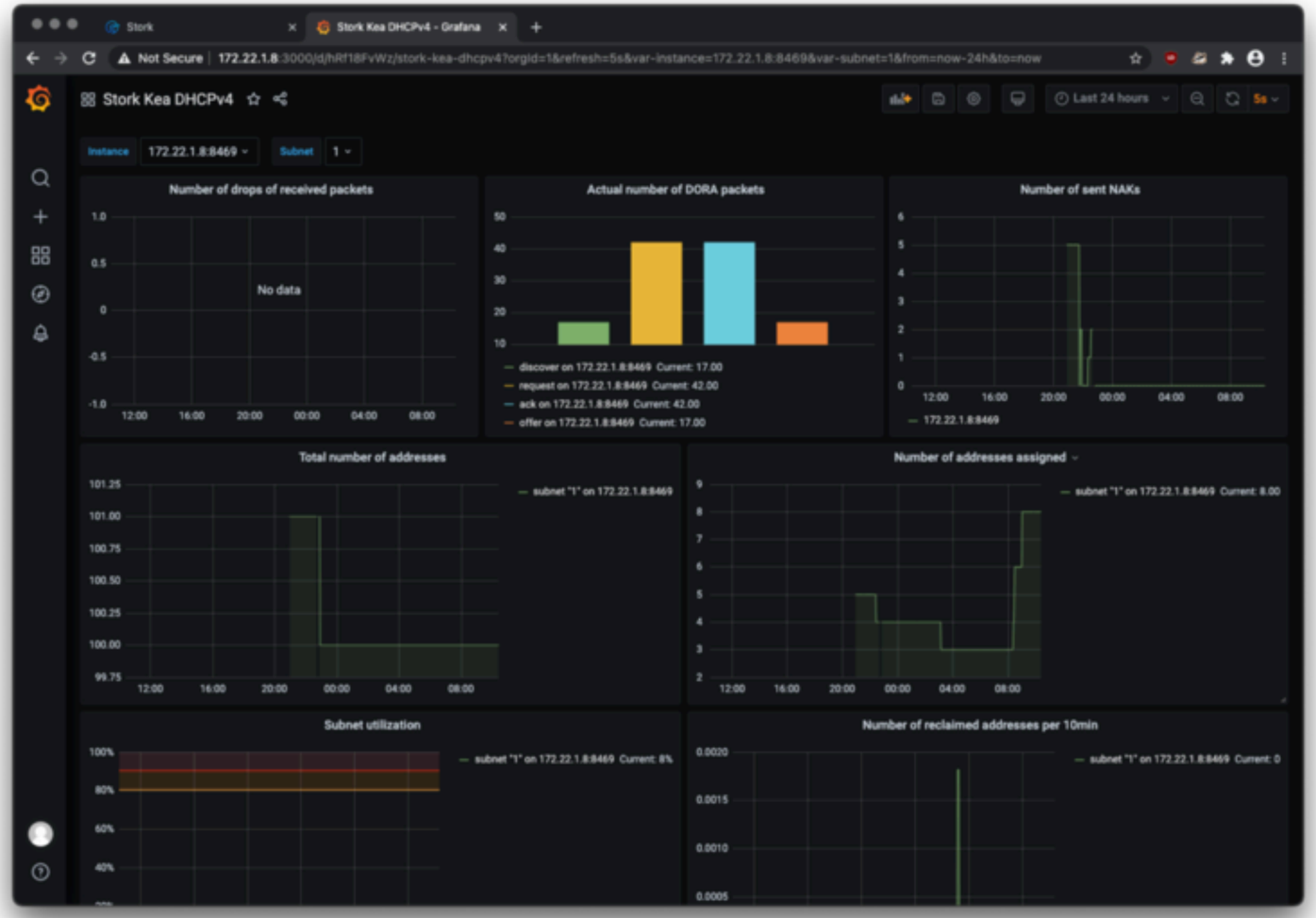
Prometheus

- 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**

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**

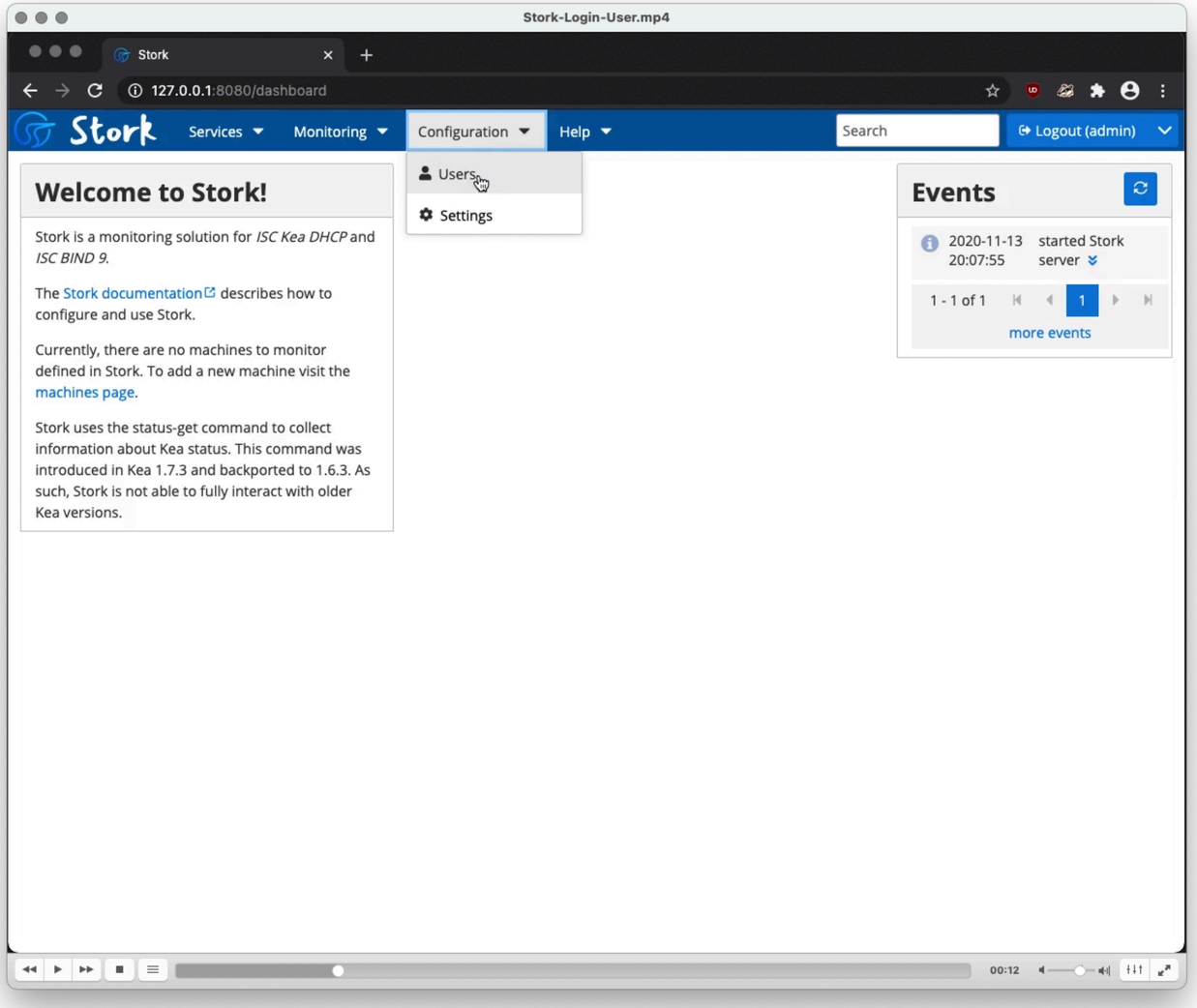
Grafana



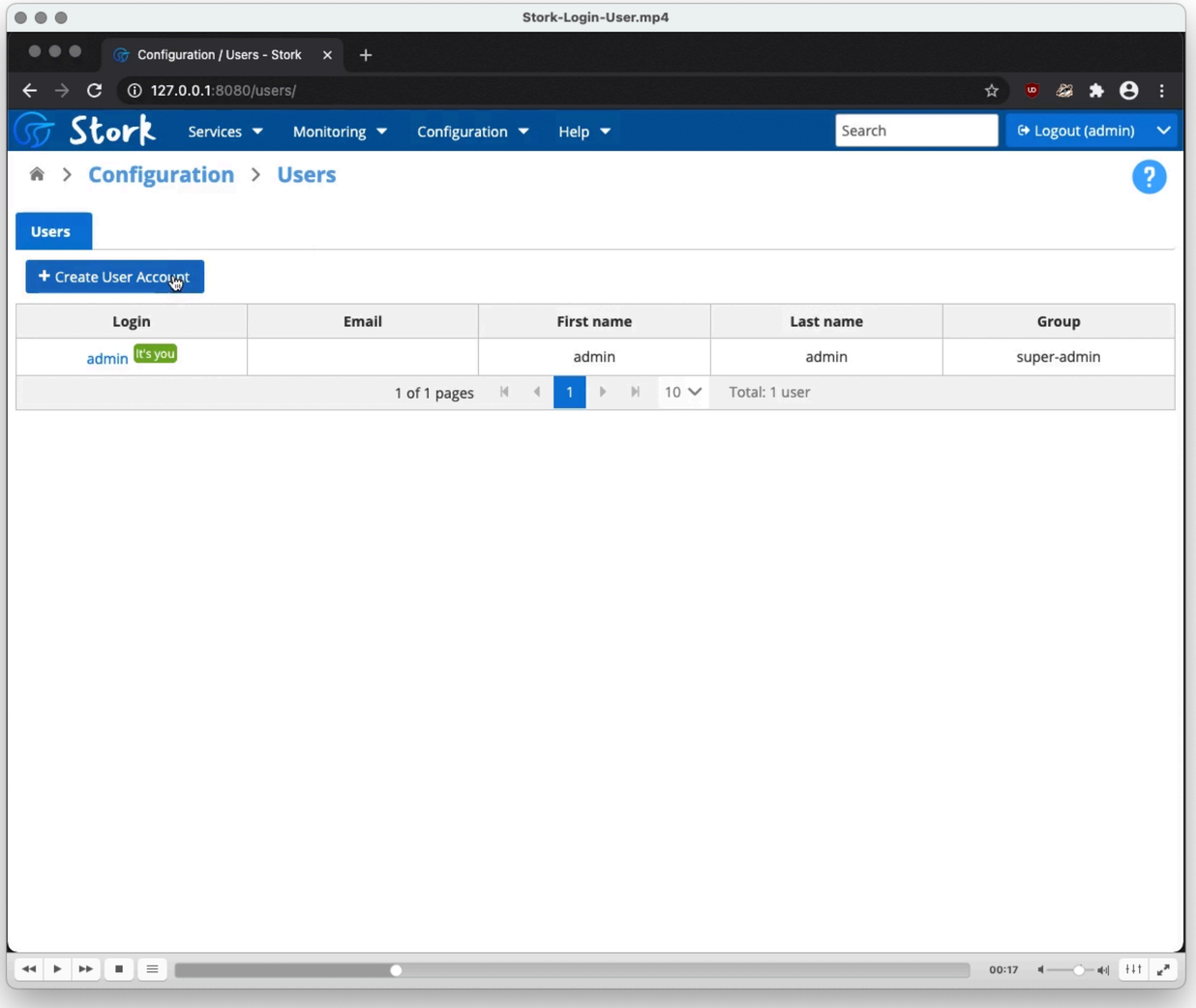
Tour a Stork

User Management

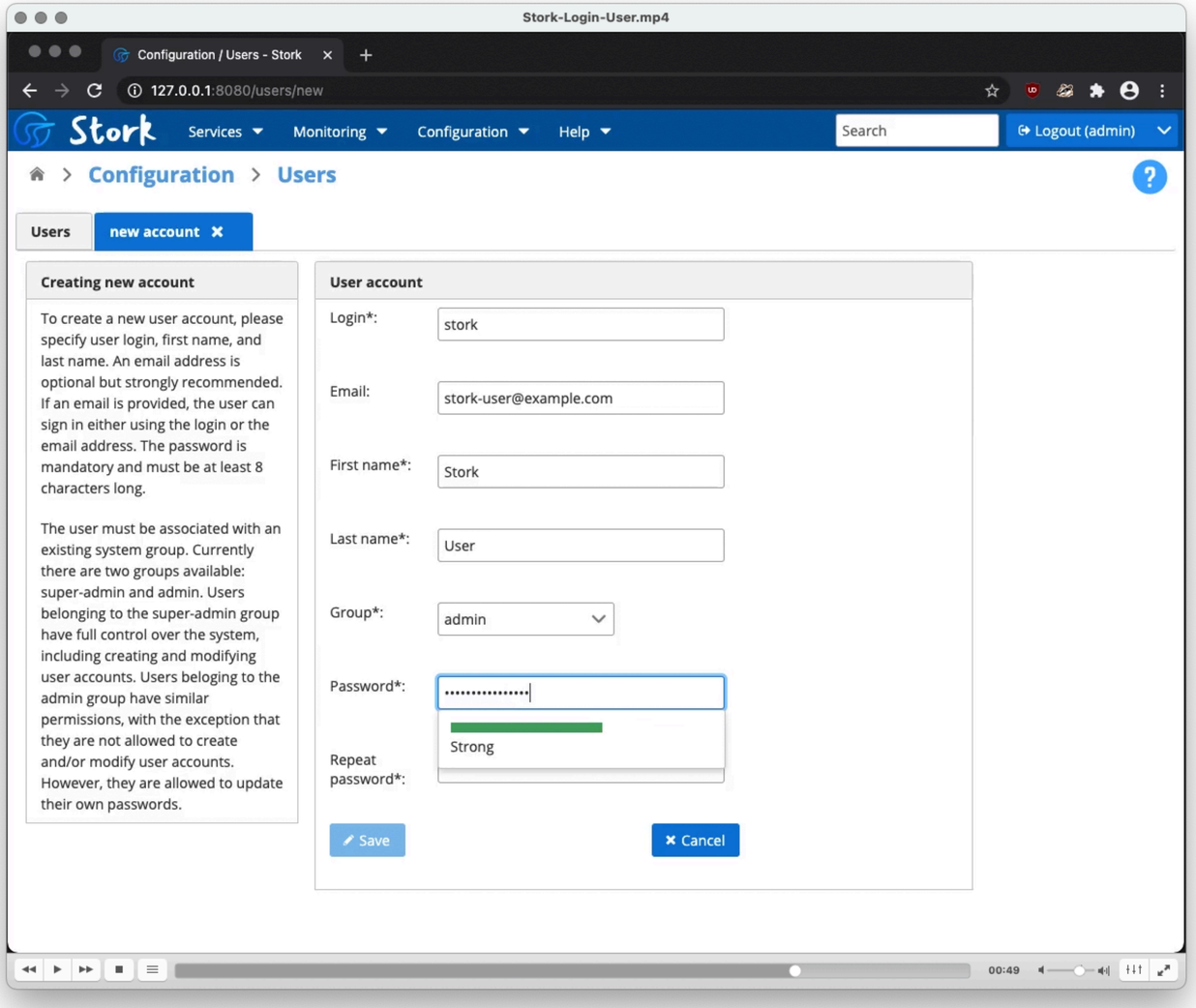
User Management



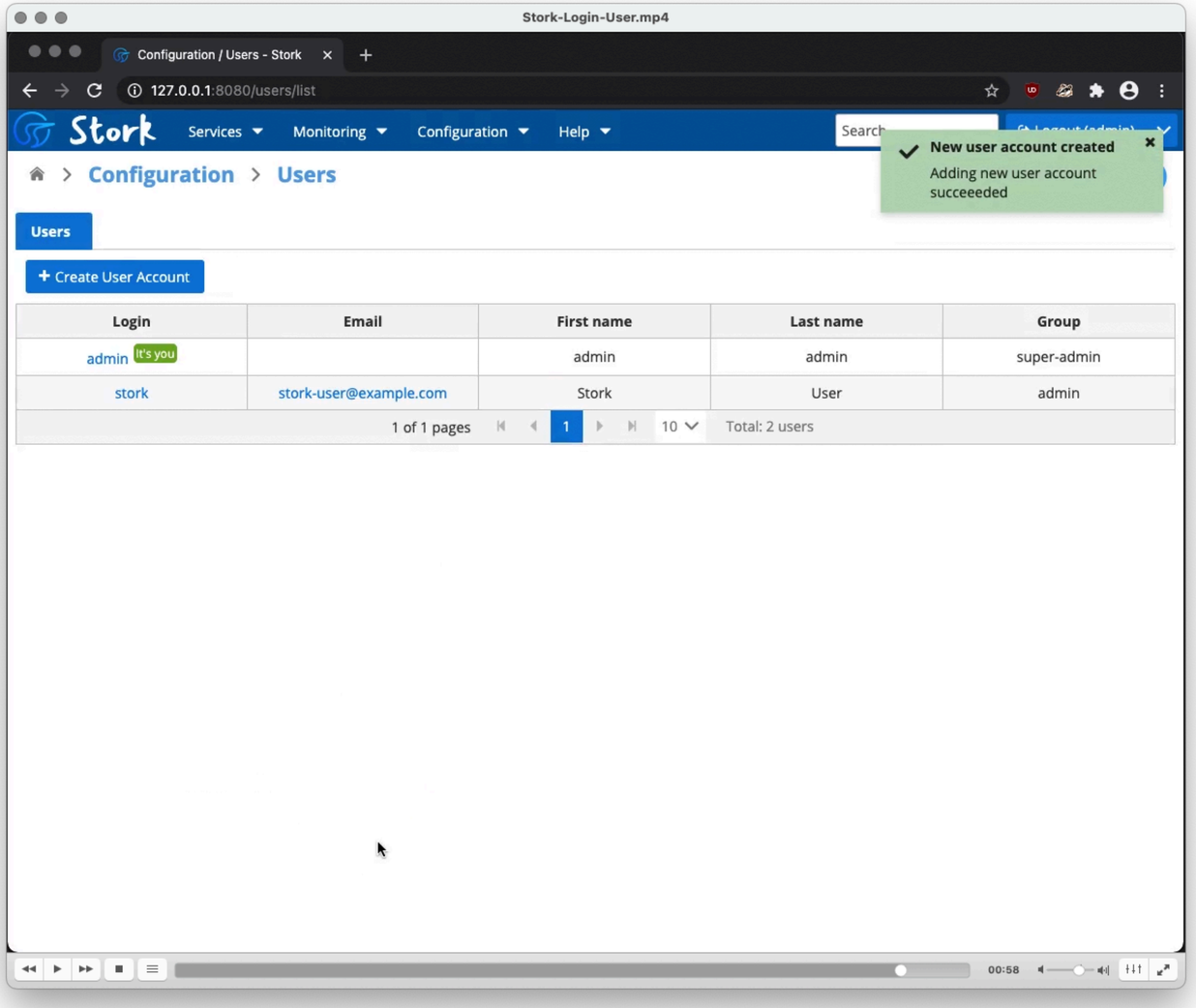
User Management



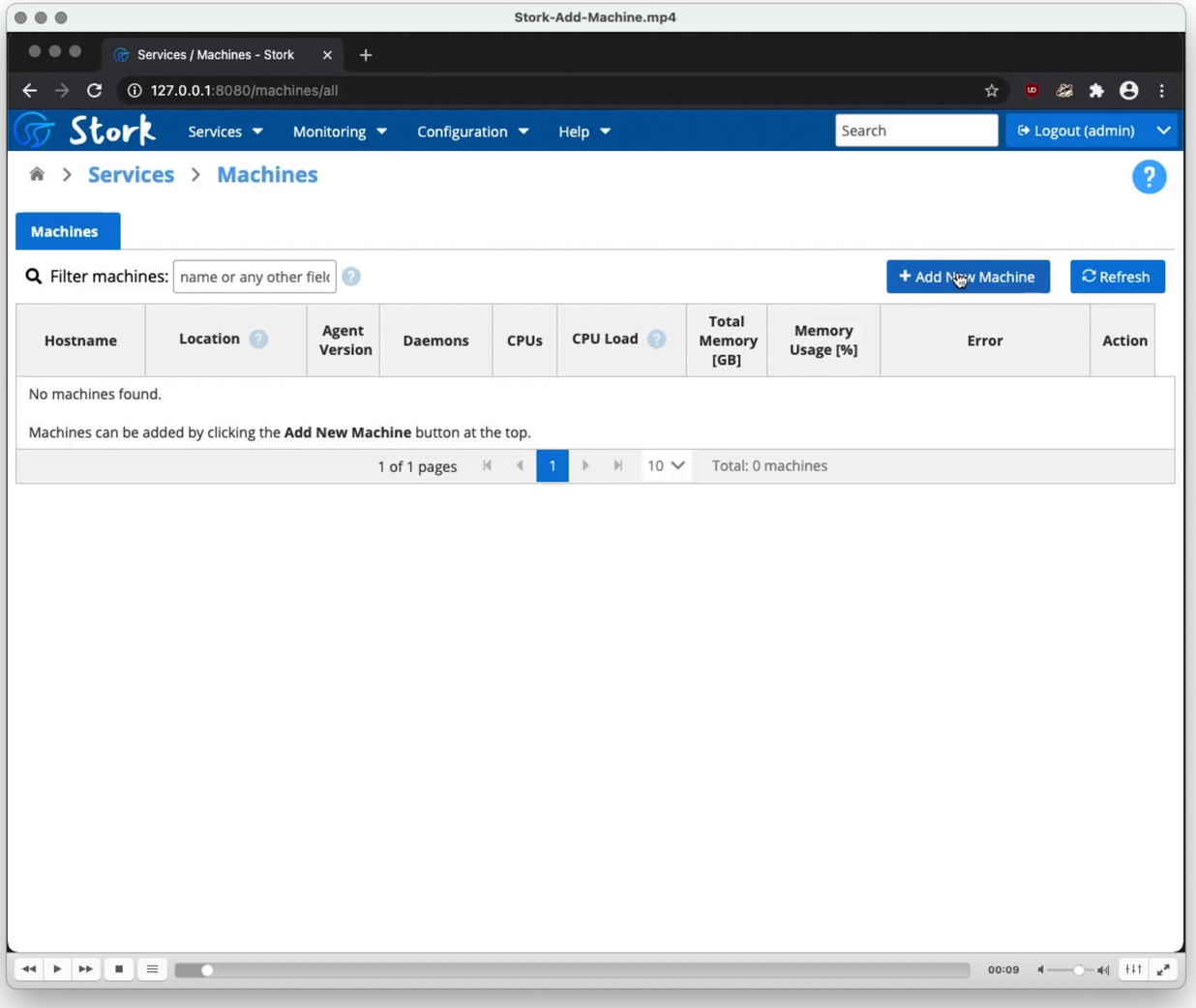
User Management



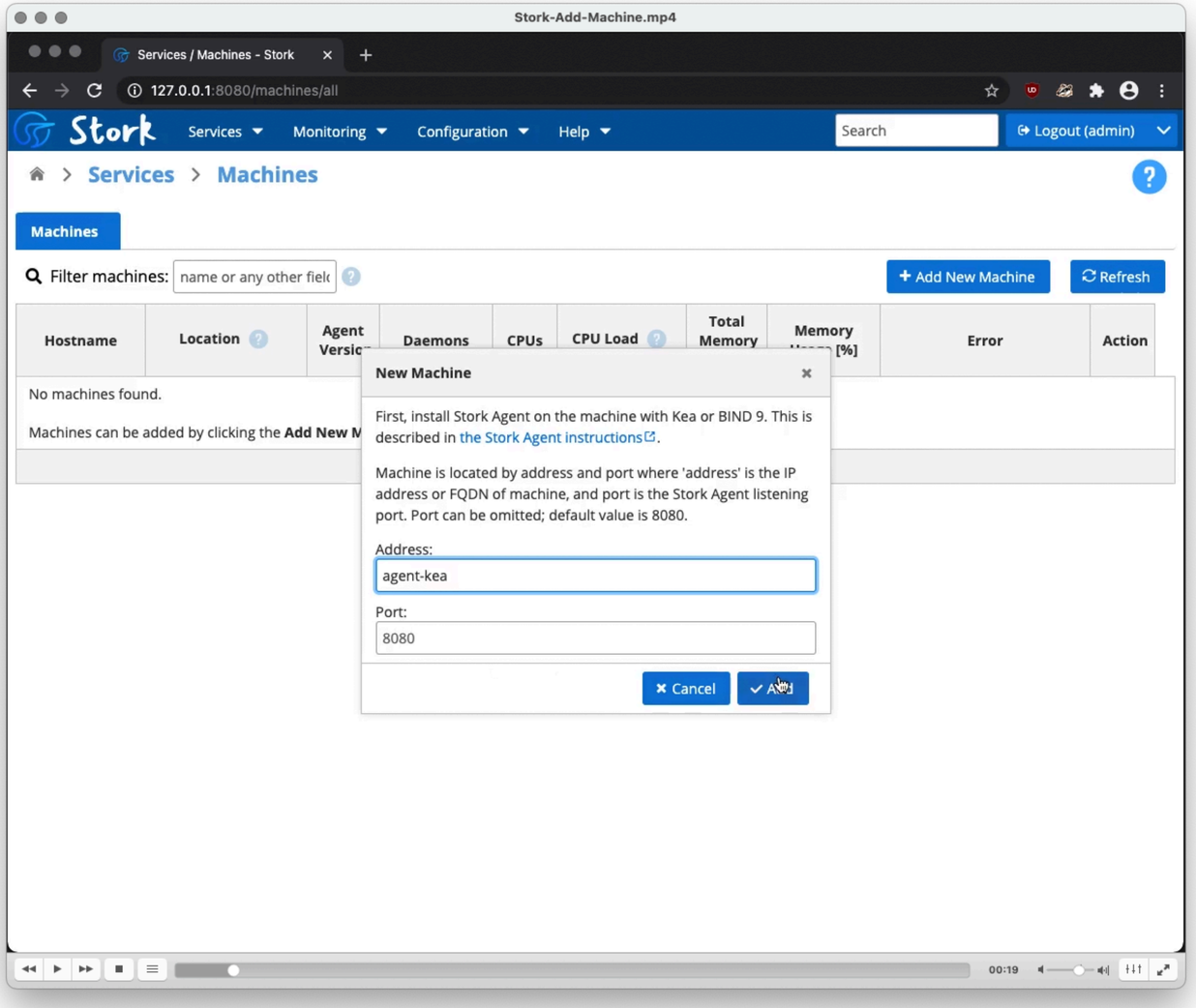
User Management



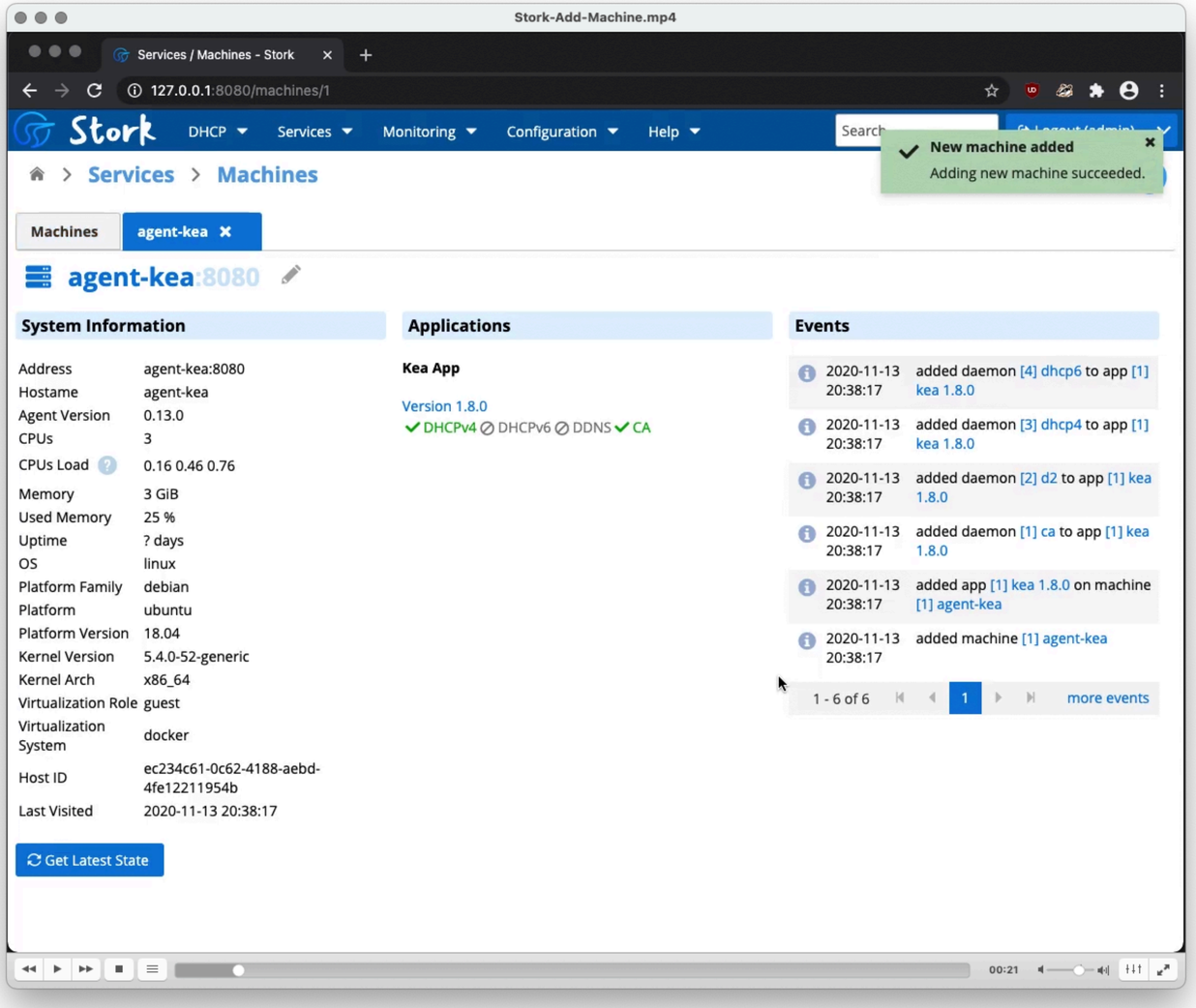
Adding Machines



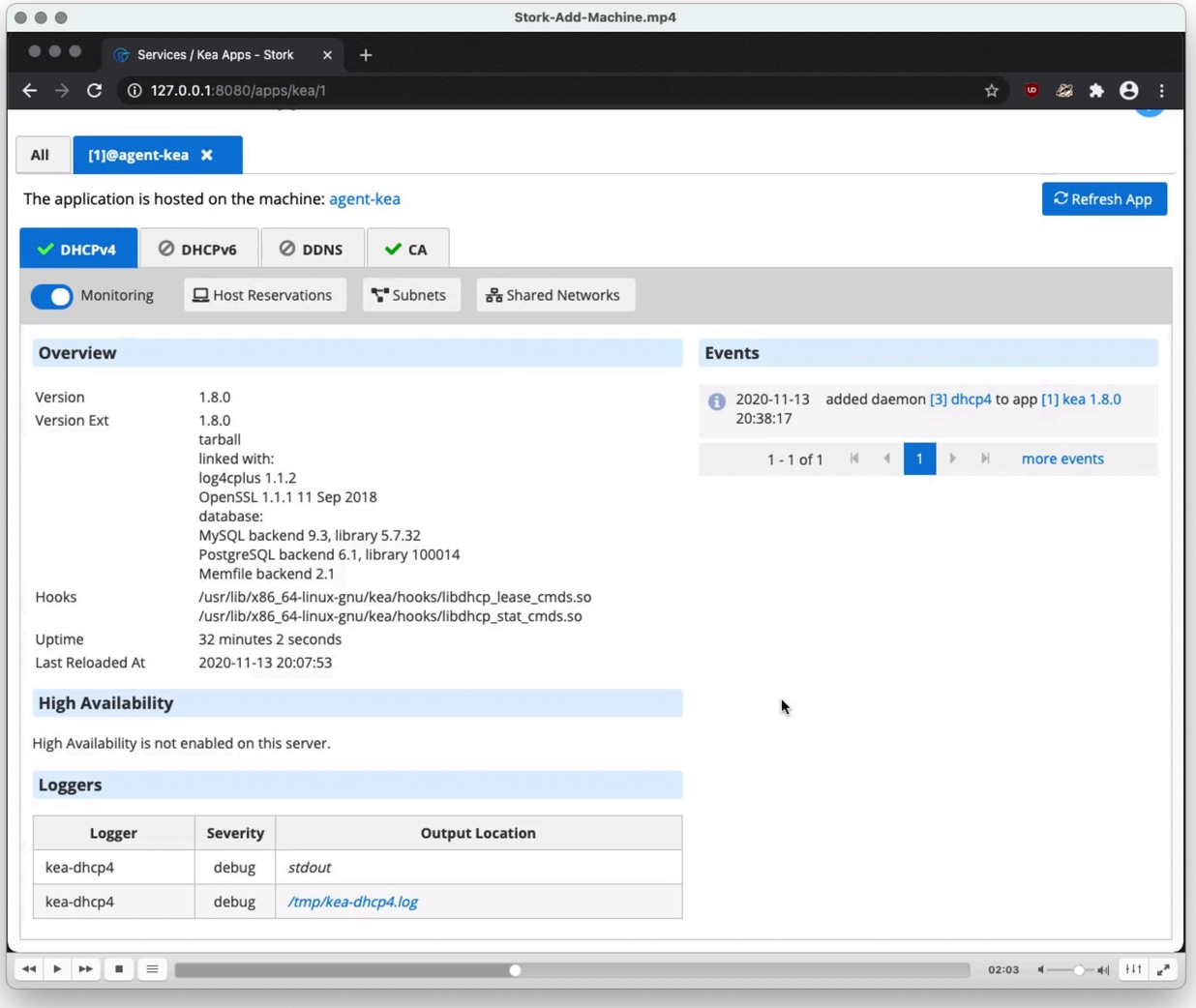
Adding Machines



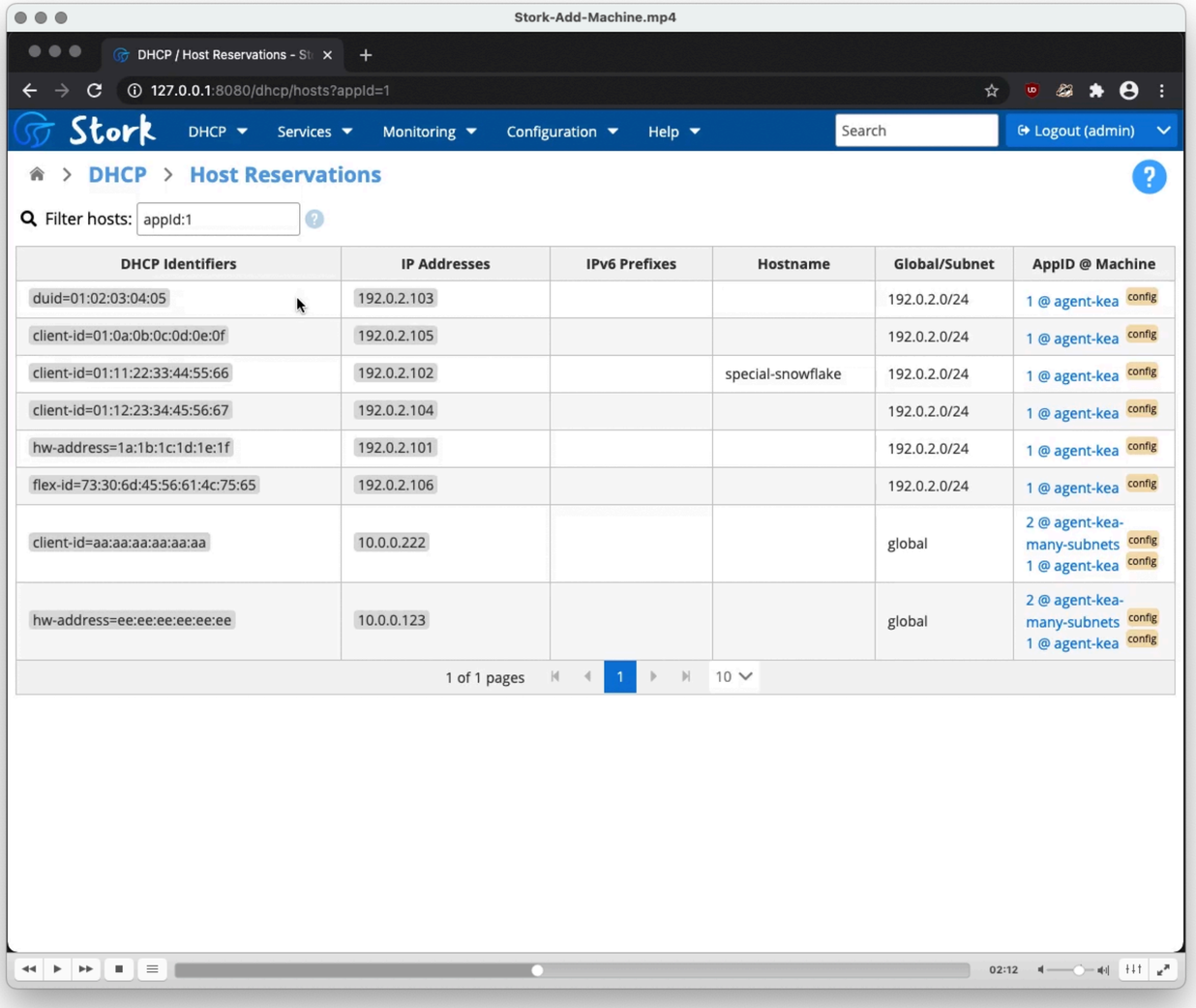
Adding Machines



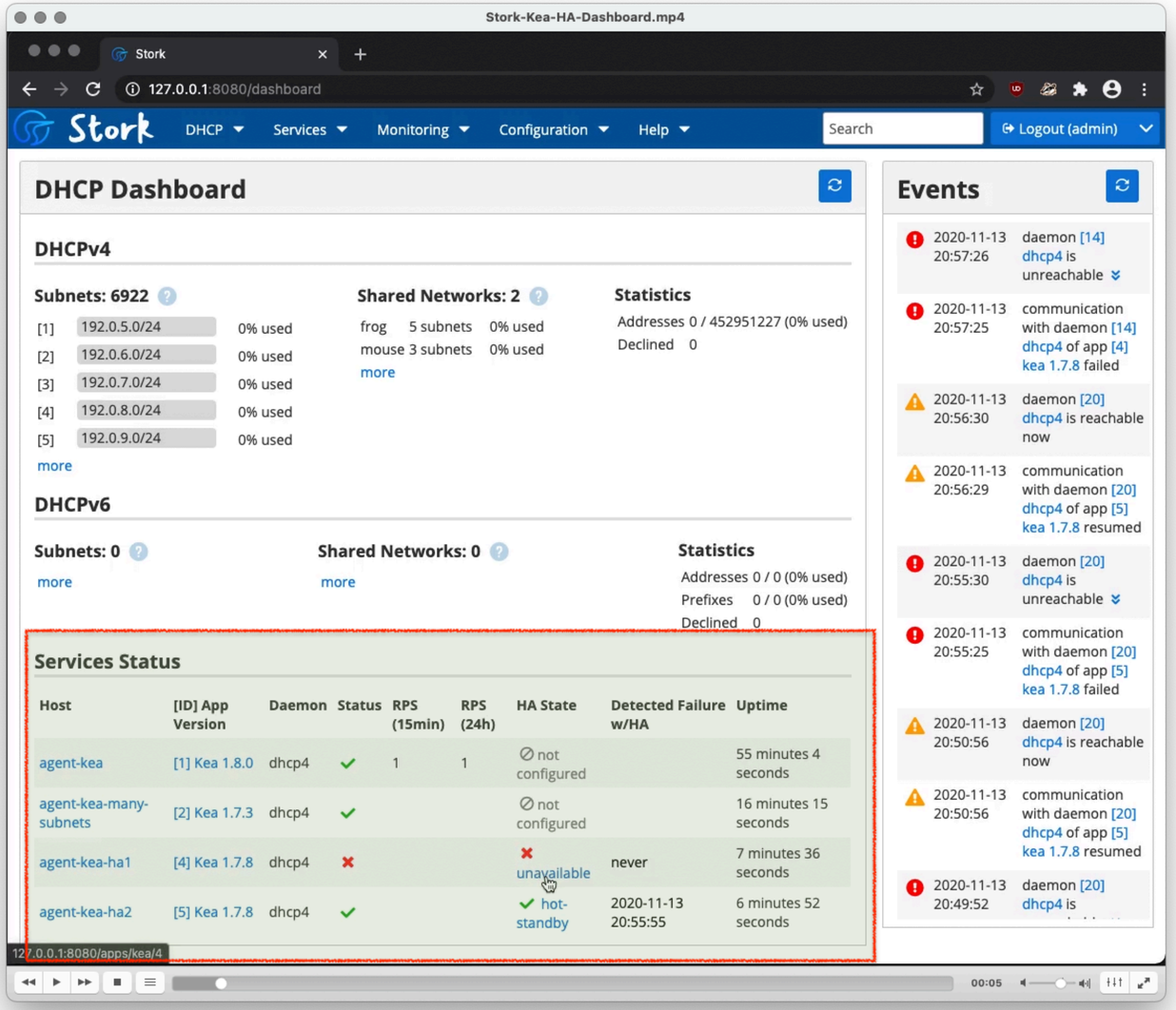
Adding Machines



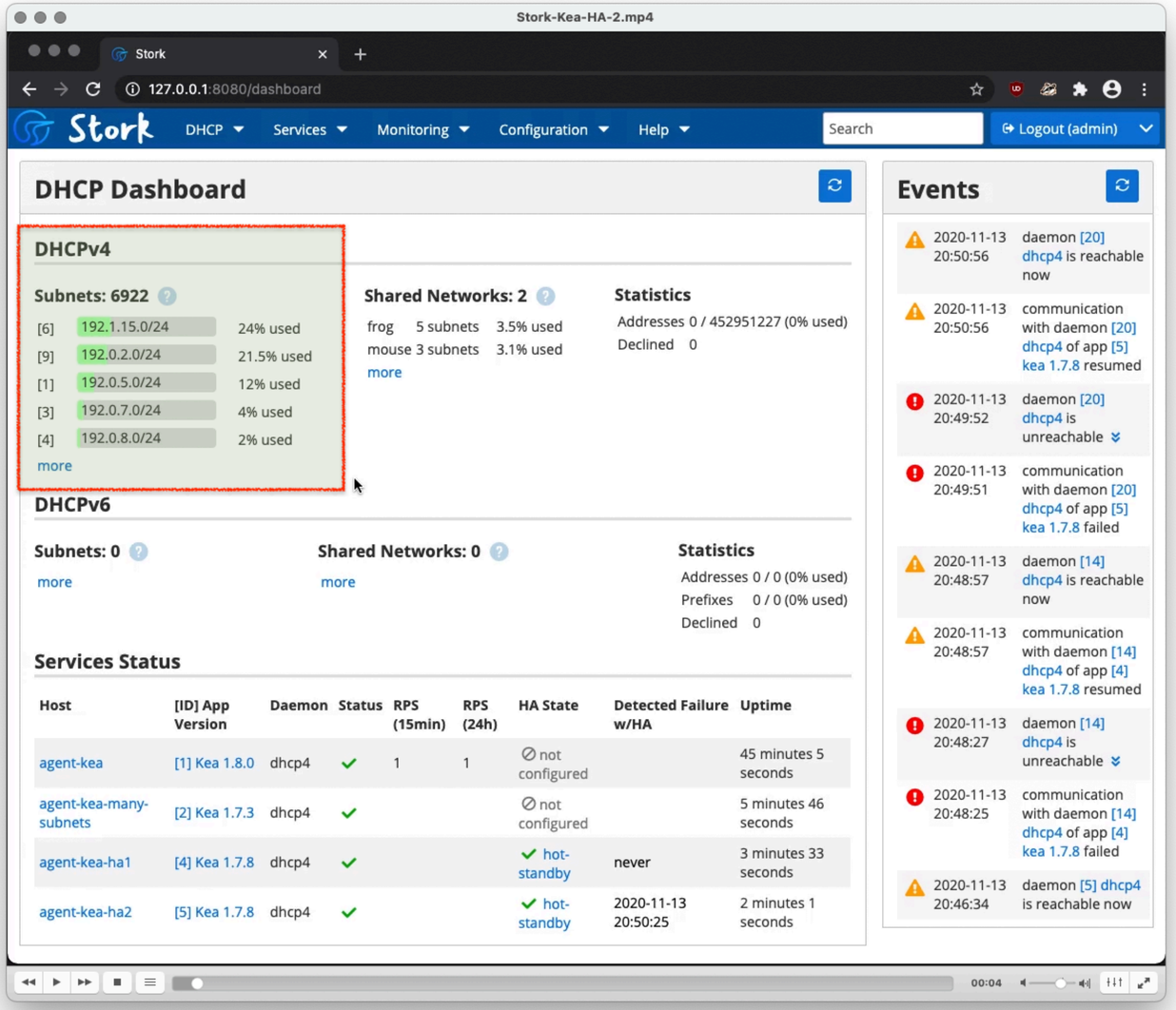
Status Information



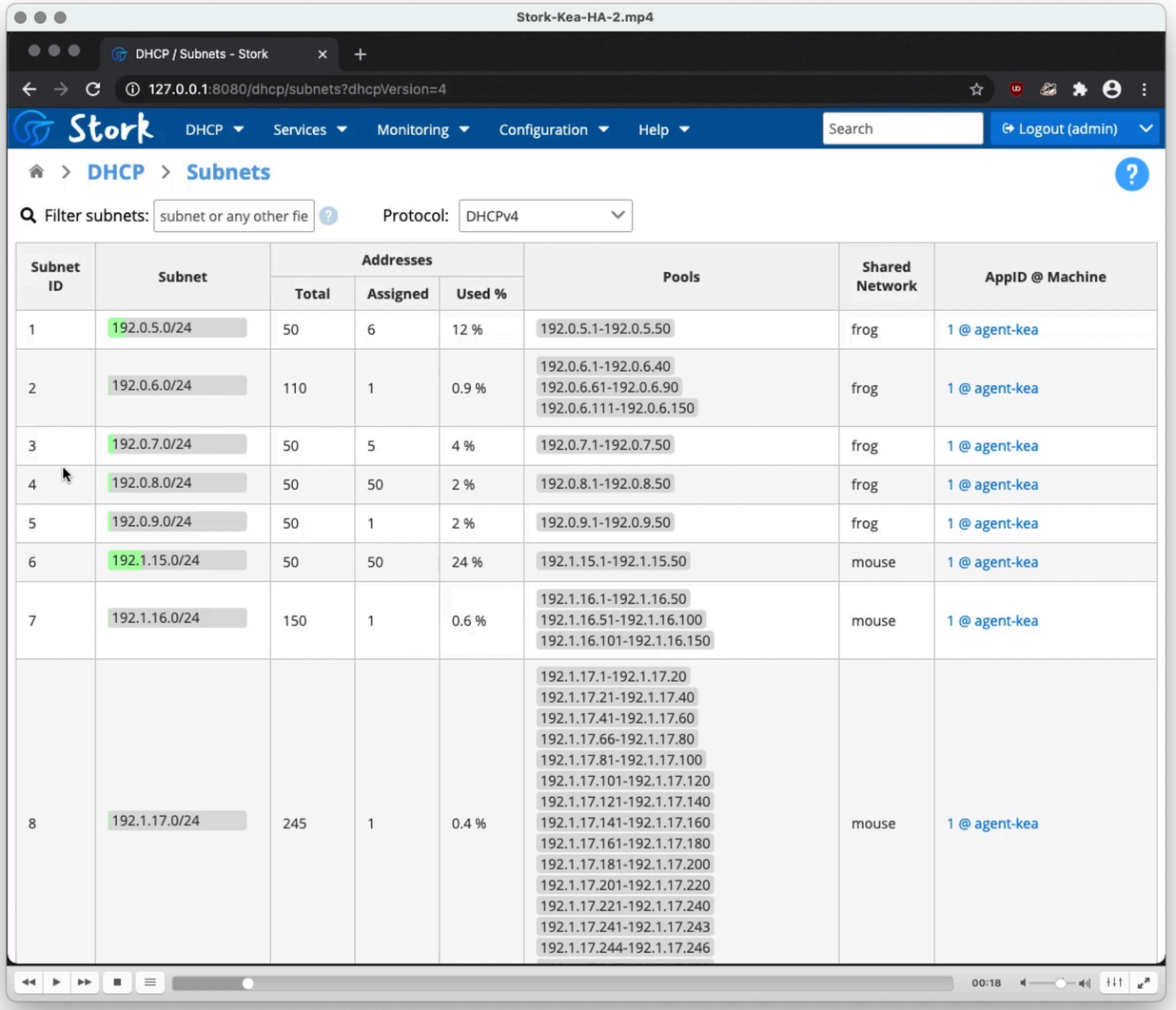
Monitoring Service Health



Pool Utilization

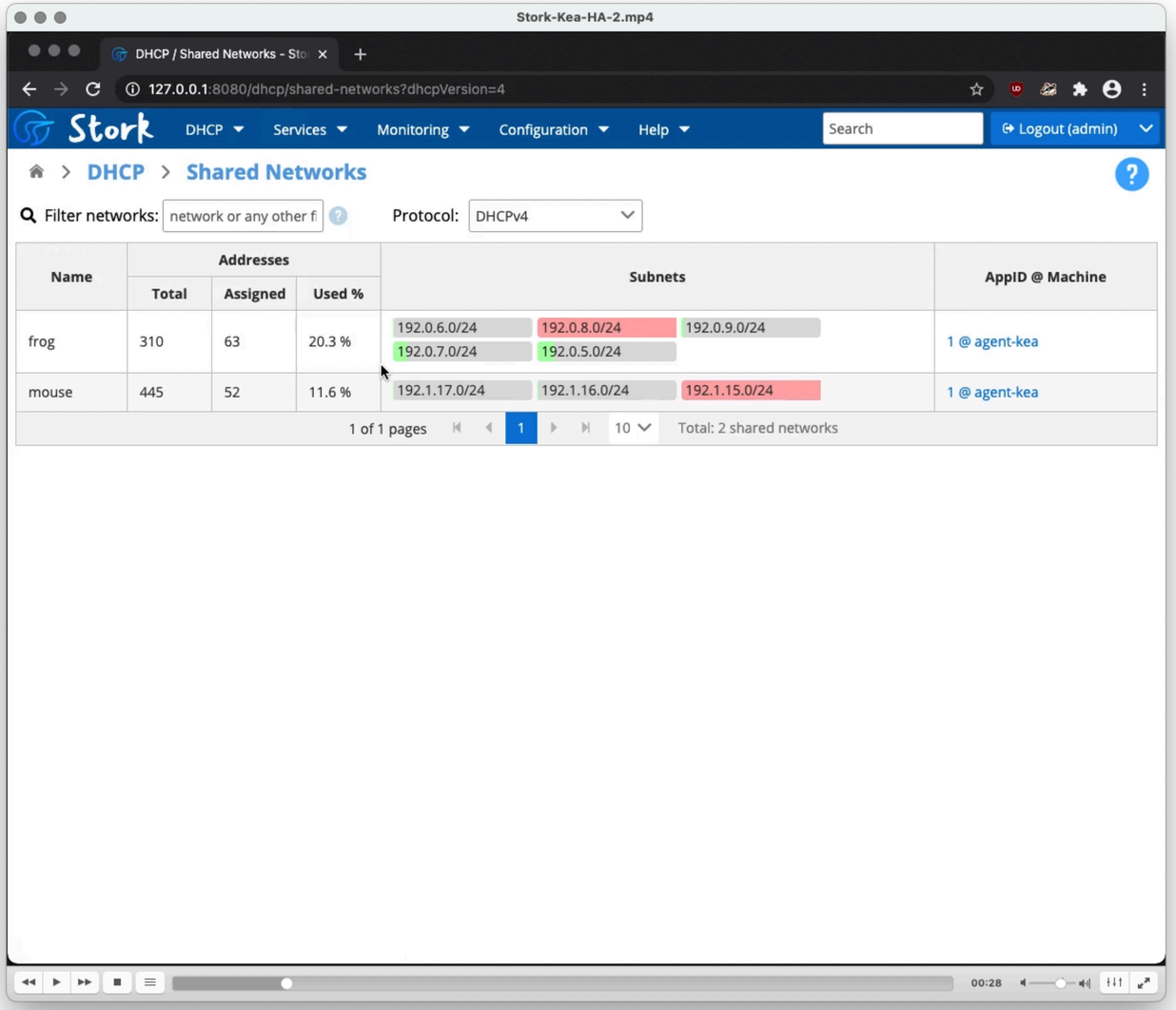


Pool Utilization

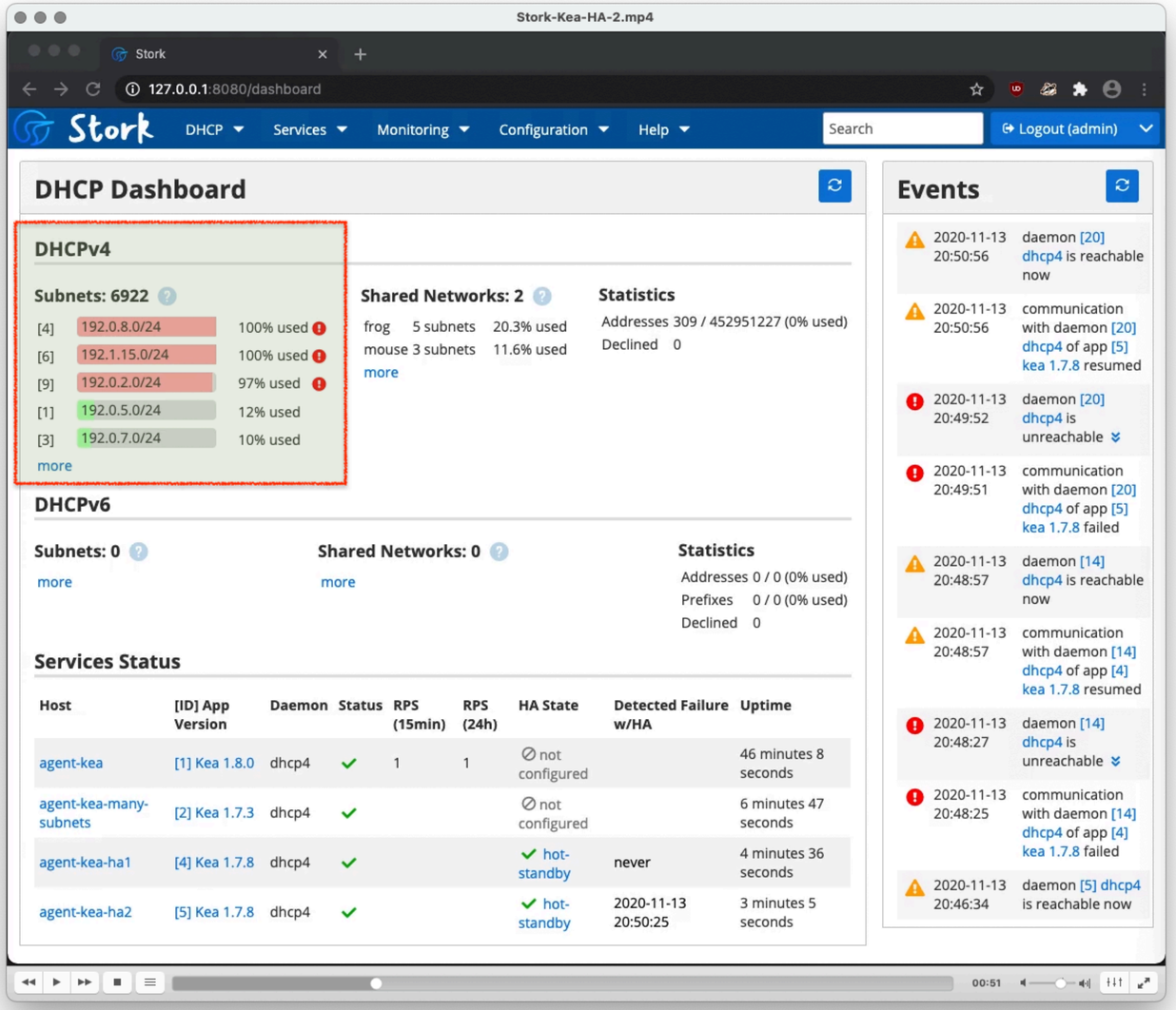


Subnet ID	Subnet	Addresses			Pools	Shared Network	AppID @ Machine
		Total	Assigned	Used %			
1	192.0.5.0/24	50	6	12 %	192.0.5.1-192.0.5.50	frog	1 @ agent-kea
2	192.0.6.0/24	110	1	0.9 %	192.0.6.1-192.0.6.40 192.0.6.61-192.0.6.90 192.0.6.111-192.0.6.150	frog	1 @ agent-kea
3	192.0.7.0/24	50	5	4 %	192.0.7.1-192.0.7.50	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

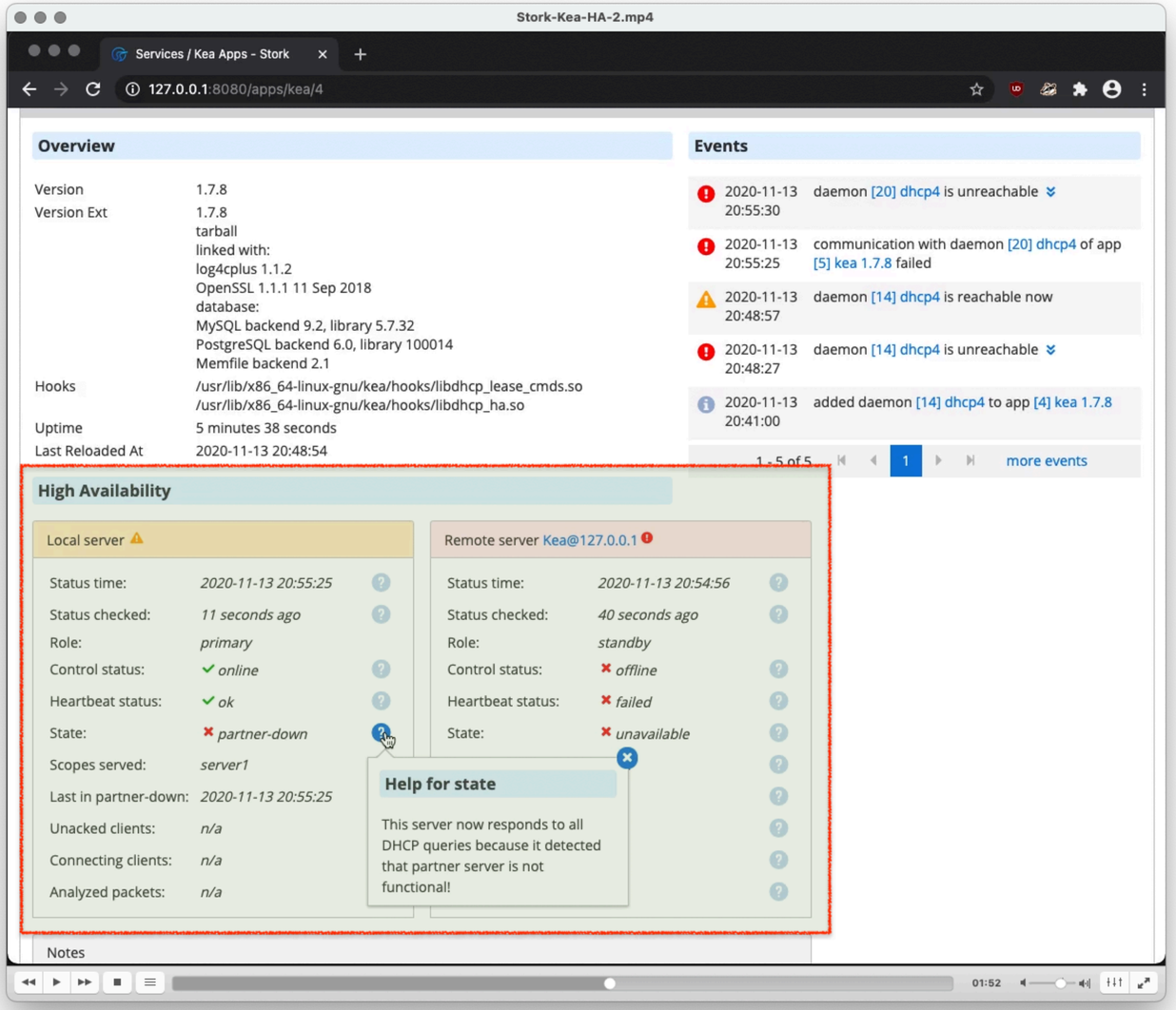
Pool Utilization



Pool Utilization



HA-Health Status

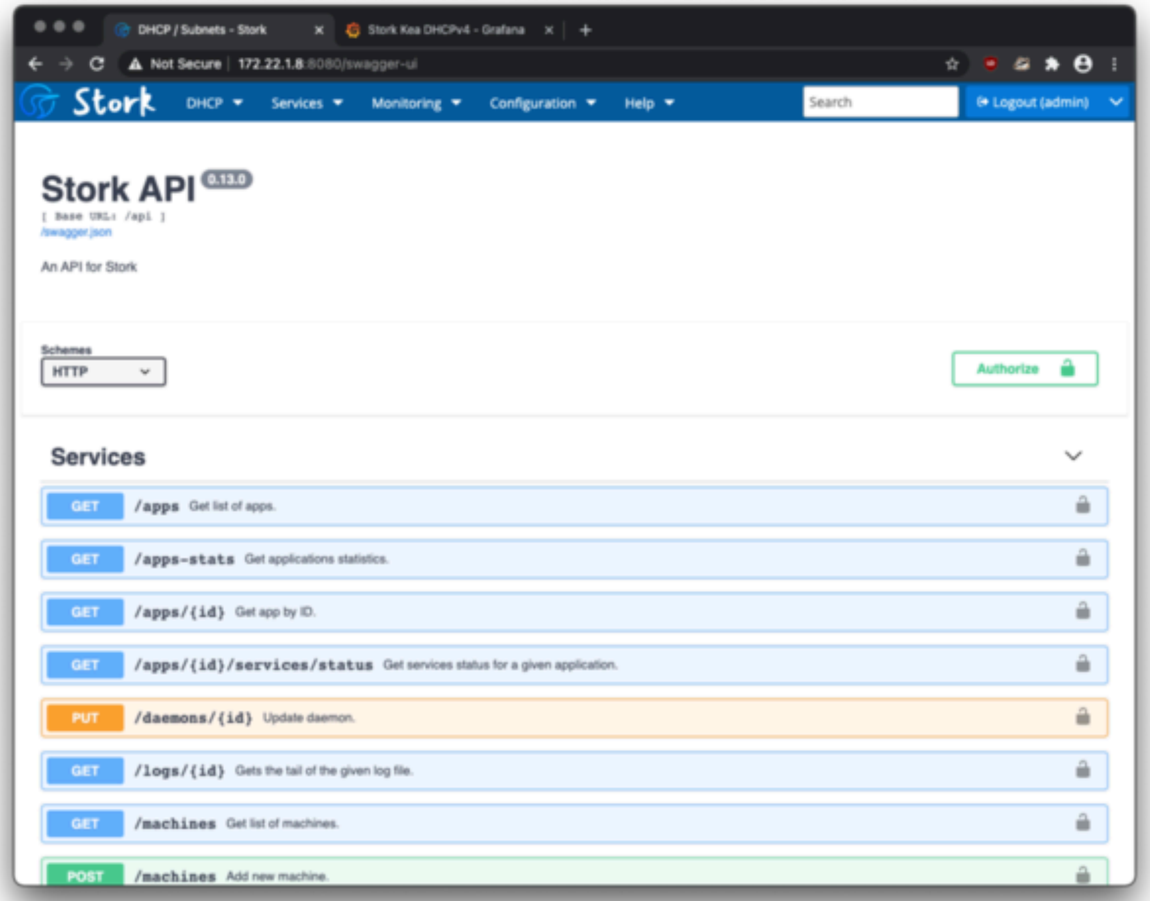


Stork REST API

- 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

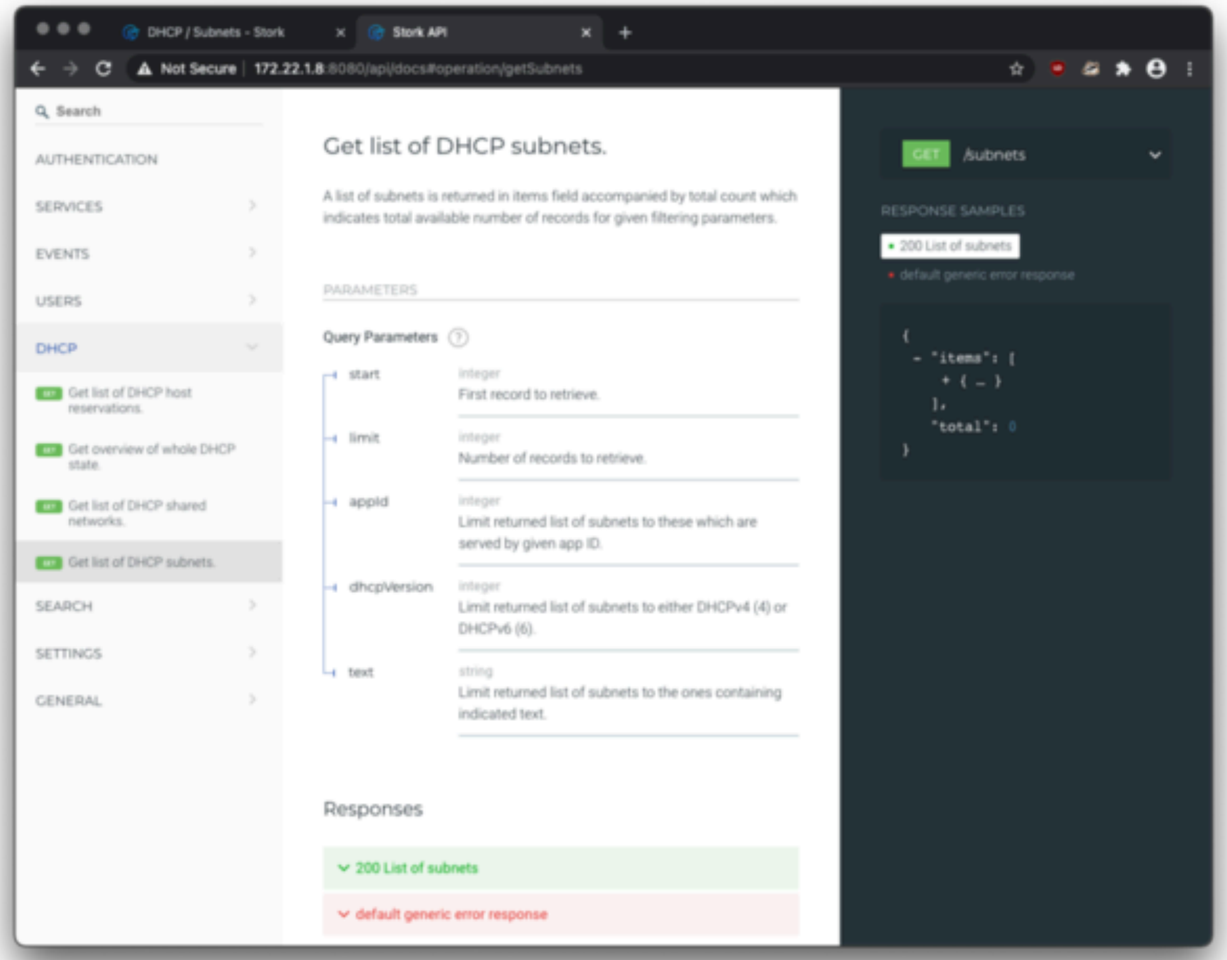
Stork REST API

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



Stork REST API

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



Other Monitoring

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
```

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
```

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
```

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
```

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`

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`

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`

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
```

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
```

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
```

DHCPtest

- another DHCP test tool
  - written in D
  - Source:

    https://github.com/CyberShadow/dhcptest

```
% ./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)
```

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

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

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 ;)

Logging

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

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
}]
[...]
```

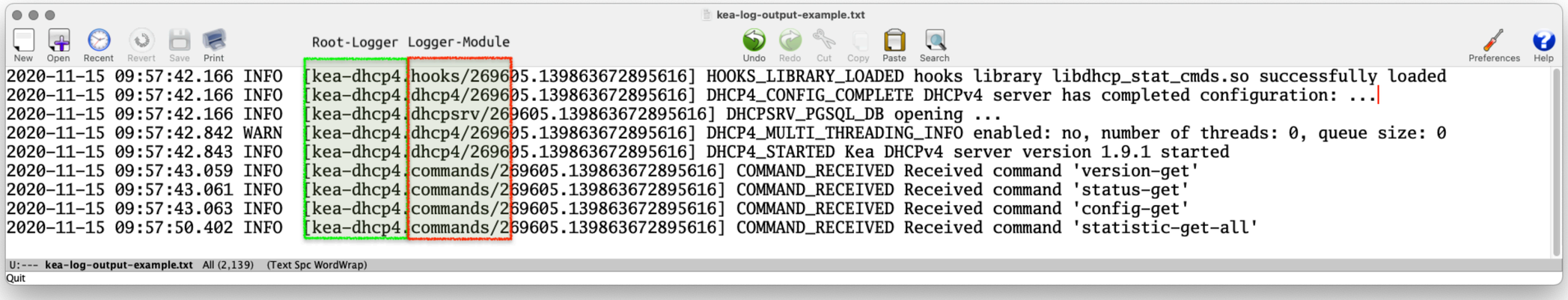
Kea Logger

- 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`

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)



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
    }]
[...]
```

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)

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/`

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
```

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
    }]
[...]
```

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>
```

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'
```

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
```

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
} ]
[...]
```

Performance testing

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

Next Webinars

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

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`

Questions and Answers