

Overview and Motivation

Kraken is a software tool used for automating and managing the state of a cluster. Current cluster management tools use a set-and-forget style of automation where an administrator sets the configuration for how a cluster should look and runs some form of configuration management software to achieve the desired configuration. However, most of these current tools require human intervention when something goes wrong during its operation. Because Kraken is reading feedback from the system, it can effectively recover a system if an error occurs during its automation process and also during a system's general running period. Below is a general explanation of a few of Kraken's components including the Dashboard which was my main focus.

Kraken Modules

Kraken modules are small add-ons that are used to make Kraken compatible with a variety of different system management components. These modules communicate with Kraken by registering mutators that allow Kraken to control and automate nodes. By using this form of communication modules can be run as microservices which increases reliability and performance.

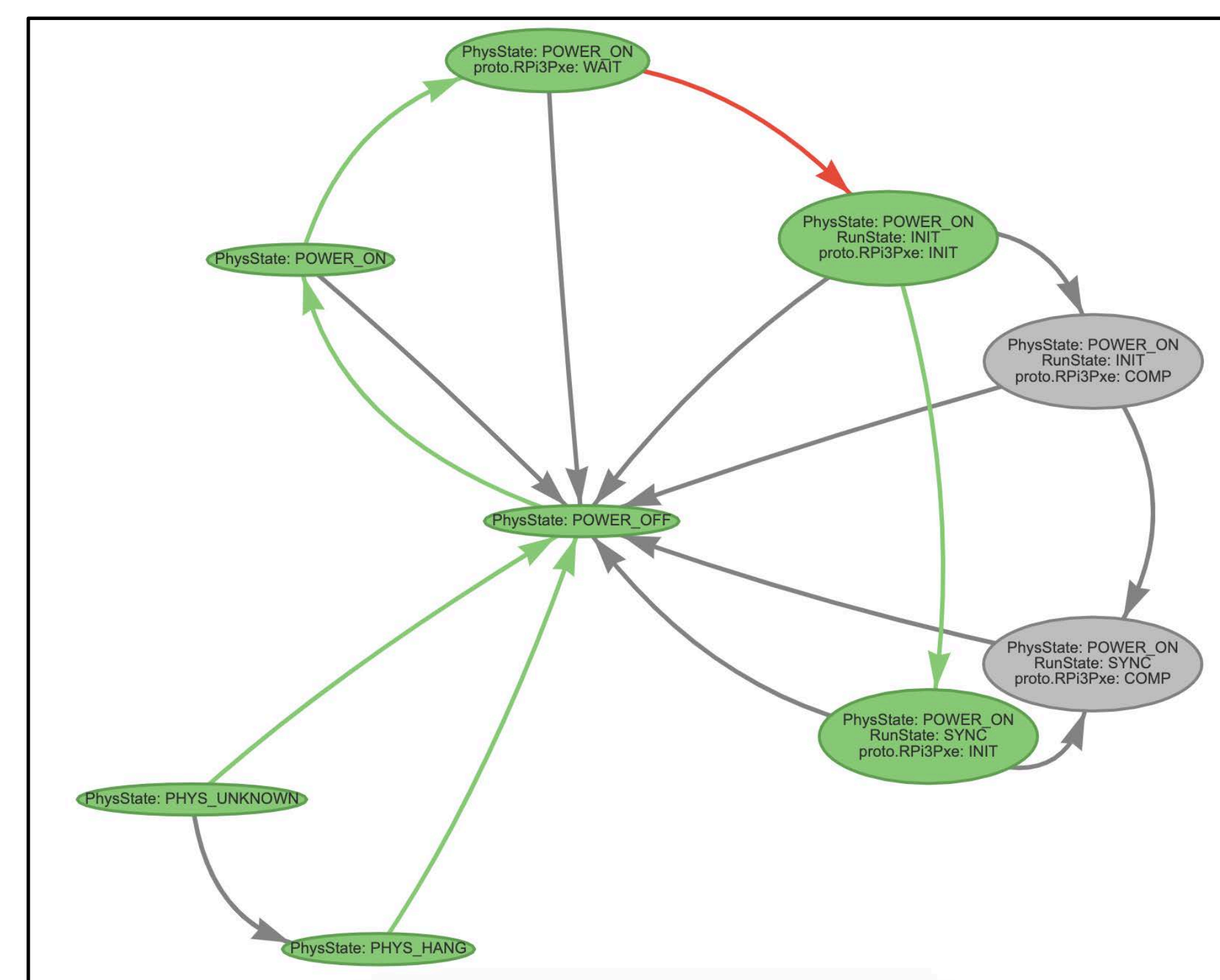
Kraken Modules Examples:

- **PowerManControl** – Allows Kraken to control PowerMan for ipmi power control
- **VBoxManage** – Used for controlling power of virtual machines
- **RestAPI** – The external communication channel used by Kraken's dashboard for reading and updating node configuration

State Mutations

To achieve fully autonomous state management, Kraken uses a state mutation graph. This graph is generated from various configuration parameters that describe the node state an administrator desires. Each graph node represents a possible state of the compute node. Kraken compares the current state to the configured state and takes the most effective path to achieving the final configured state. Below is an example of a state mutation graph for booting a Raspberry Pi cluster.

- - Possible mutations
- - Mutation chain
- - Current mutation



This state mutation graph is featured in the dashboard and was created by pulling live node information from Kraken's RestAPI.

Future Plans

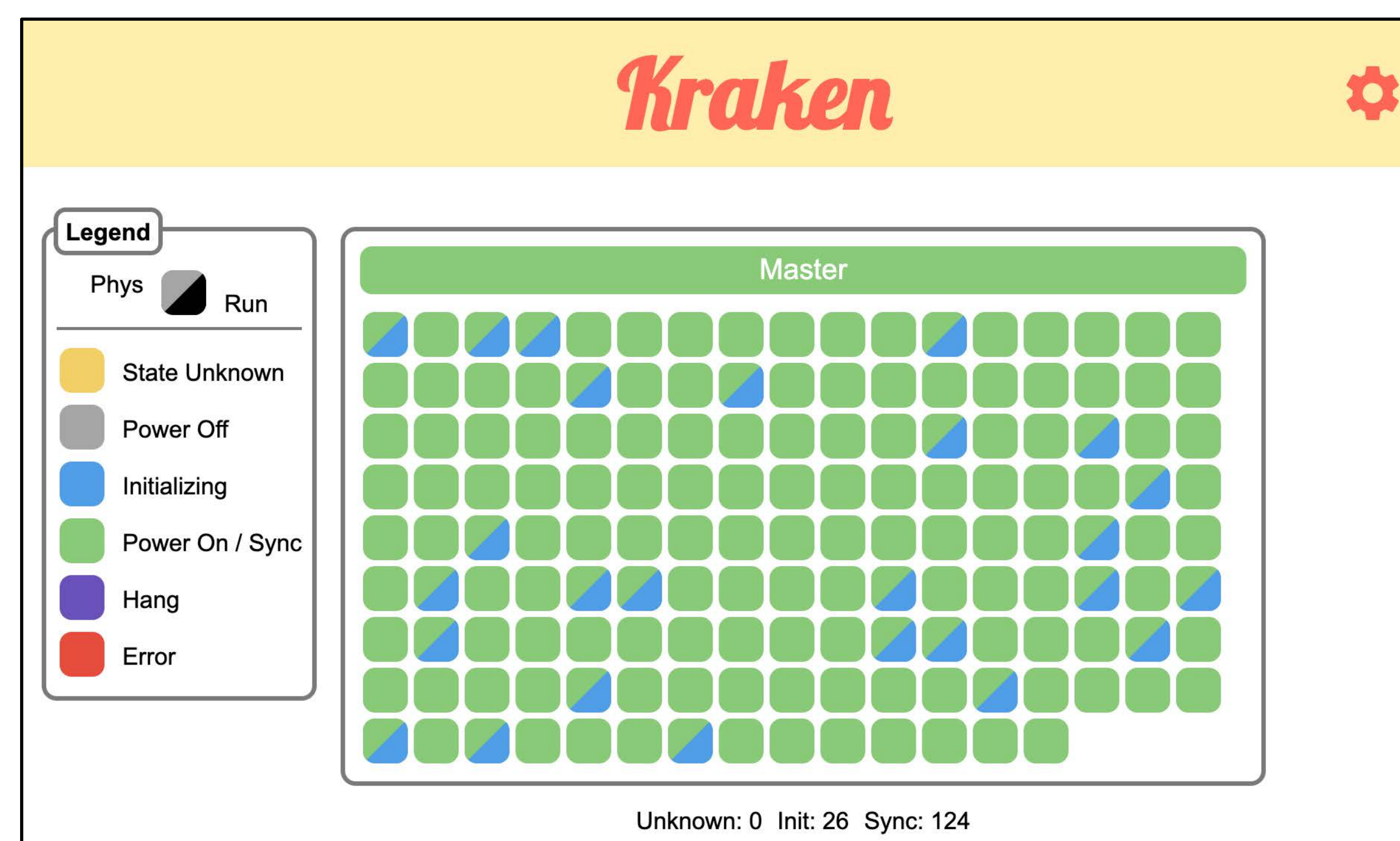
Kraken is an open sourced project on github and still has future plans for development. Below are just a few of the projects that are planned.

Kraken's Future Projects:

- **Image layering** – Kraken will be able to layer container images to provision a system.
- **Cryptography** – Communication channels between child nodes and parent nodes will be secured with x509 certificates to ensure trust within the cluster. Certificates will also be used to secure communication to the RestAPI.
- **System Orchestration** – A small service will sit on top of Kraken that will allow for easier management of an entire cluster (or multiple clusters).
- **RestAPI Web Sockets** – Being able to communicate to the RestAPI using web sockets can allow for more efficient communication to the dashboard.

Dashboard

The dashboard is a Node.js application that displays live updated information about the nodes' current state. It is written with React libraries to efficiently visualize rapid changing data that is being pulled from Kraken's RestAPI.



The main dashboard (left figure) features a grid of color-coded nodes that represent a cluster that is being automated with Kraken. The current state of each node is represented by the combination of colors that make up two corners of the square

Further information about each node can be accessed by clicking on the squares in the grid. This will display the node details page (right figure) where information such as current and configured state, networking configuration, and running modules can be found. There is also a window to view a node's state mutation graph including its current mutation chain (pictured under State Mutation Graph).

