Power management budgets. The first step to understanding the power/performance tradeoffs for different algorithms is the observation and study of power caps, which are likely to be a reality on future top supercomputers. Practical power delivery concerns will impose some limits on the power targets for Exascale computing. Hardware improvements, particularly in ultralow-power systems, will be necessary to keep costs down and meet the new constraints with the power management policies.

Extreme-scale computing requires that power and energy budgets be carefully managed. While much of the work of achieving energy efficiency is done in software, the role of hardware is critical. Software is useful for investigating and understanding the complex behavior of application performance, but hardware is needed to understand the underlying mechanisms leading to the performance behavior.

Overview of the Power API

**Motivation**

Software has shown that power and energy budgets can be efficiently managed. While much of the work of achieving energy efficiency is done in software, the role of hardware is critical. Software is useful for investigating and understanding the complex behavior of application performance, but hardware is needed to understand the underlying mechanisms leading to the performance behavior.

**API Design**

The Power API provides a method of describing systems through a collection of objects and observations. The Power objects include interfaces to all major layers in the HPC stack, including the hardware power management. The interface implementations can provide an array of data in various formats, including graphical data.

**Interface Example**

The interface is designed to be flexible and extensible, allowing different providers to add additional features and capabilities.

**Prior Experience with Top Supercomputers**

The Power API has been deployed on the Kraken cluster, which is the most powerful supercomputer in the world. The Power API has been integrated with the Kraken cluster, and the results have been encouraging. The API has been used to collect data on power consumption, network performance, and other metrics.

**Concurrency Throttling**

The Power API provides a method of describing systems through a collection of objects and observations. The Power objects include interfaces to all major layers in the HPC stack, including the hardware power management. The interface implementations can provide an array of data in various formats, including graphical data.

**References**