Dynamic Login Node Resource Control and Monitoring with Arbiter 3

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Problem: Shared Interactive Resource Allocation

Challenge: Provide best quality-of-service to interactive users of a shared resource.

- Fair – No single user hogging a node
- Reliable – User experience consistent
- Bursts – Allow for short bursts of high utilization

Problem: Shared Interactive Resource Allocation

Static Limits?

- Poor utilization
- Not bursts

Proportional Limits?

- Unpredictable UX

Solution: Arbiter monitors resource usage in real-time and gently constraints users that violate resource policies.

- Fair – No single user hogging a node ✓
- Reliable – User experience consistent ✓
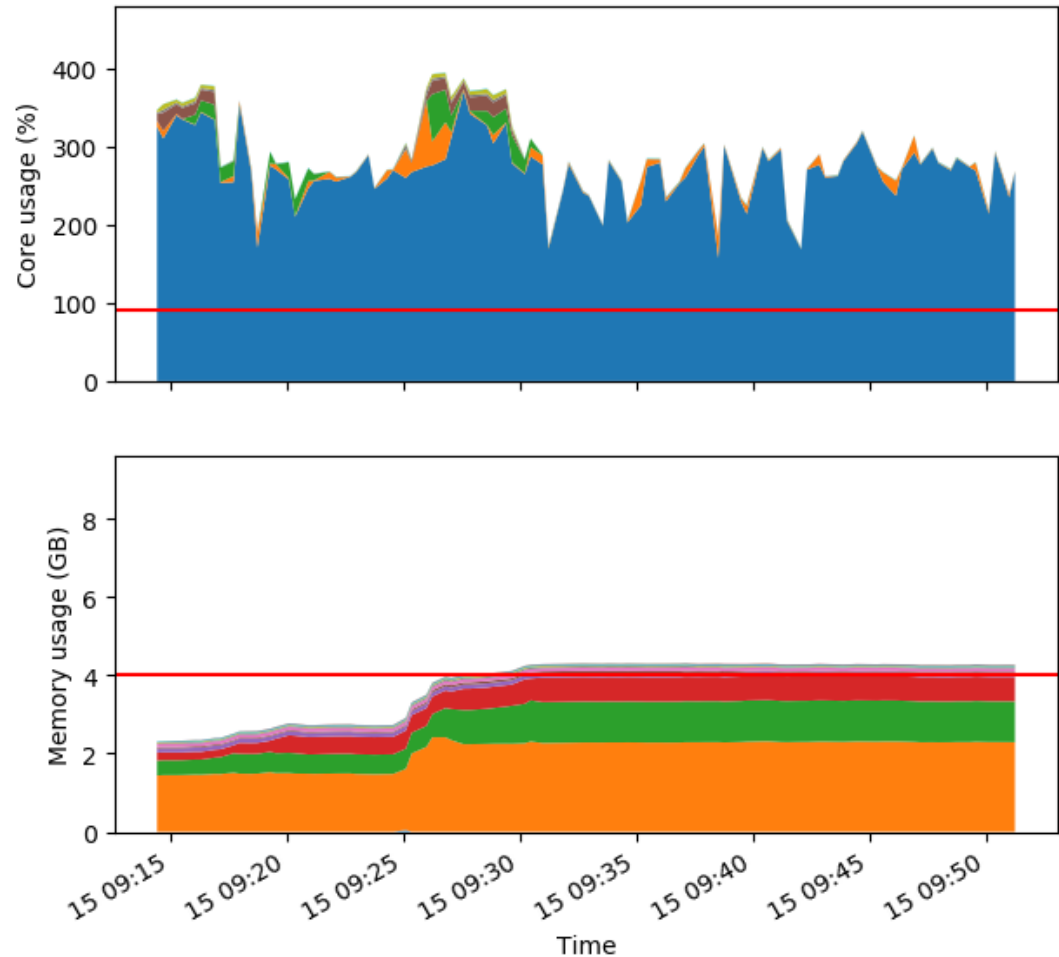- Bursts – Allow for short bursts of high utilization ✓

Arbiter2

Features
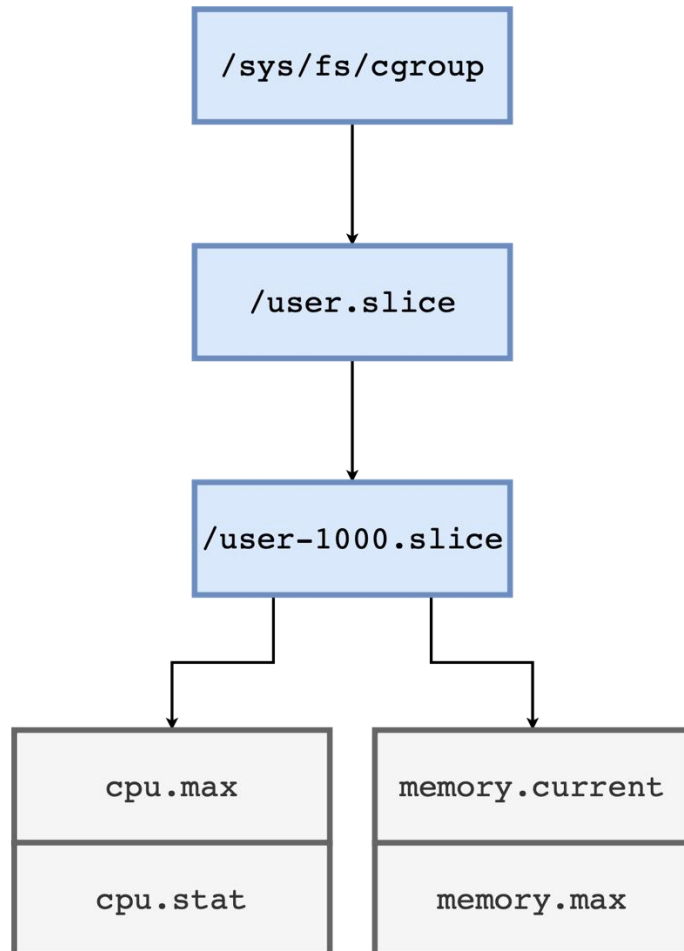
- Dynamic scaling

- Notifications

Issues

- V2 support
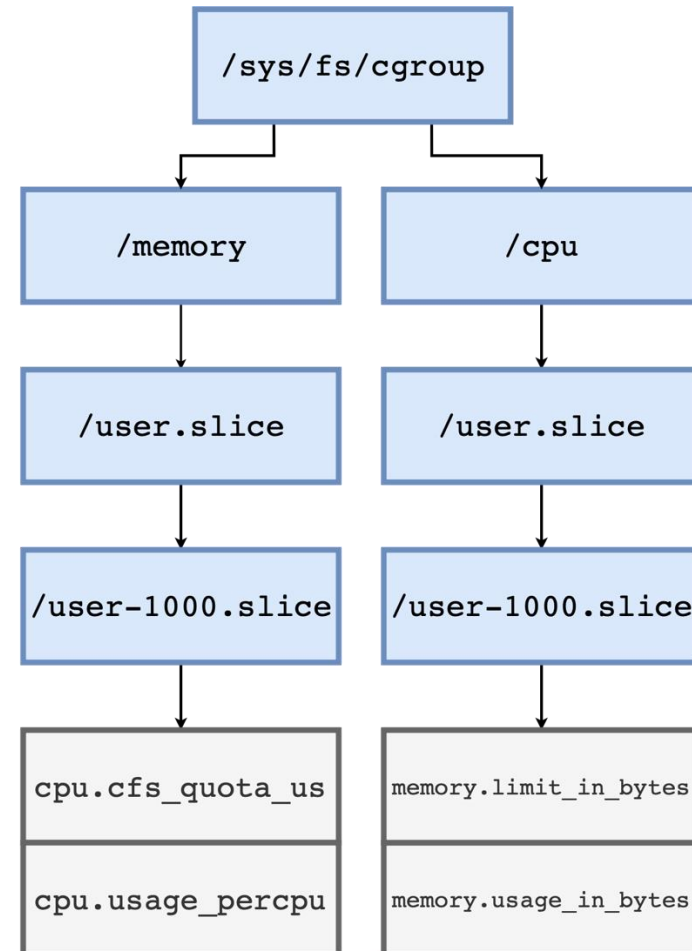
- Synchronization

- Installation

Linux cgroups

Arbiter3

Improvements

- Deployment and Configuration
  - Web GUI
  - Single source of configuration
  - Interactive nodes run single binary
- Performance
  - Go > Python
  - Offload policy evaluation
- Flexibility
  - Use new or existing Prometheus-based monitoring system
  - Policies are expressed as PromQL queries on arbitrary metrics
  - Policies and systems can be added/removed on the fly

User Evaluation and Enforcement

- Evaluation with Prometheus
  - Offload work to TSDB
  - Time-series means no proxy 'badness' score

  ```
  rate(systemd_unit_cpu_usage_ns{instance="notchpeak1.chpc.utah.edu"}[15m]) / threshold > 1
  ```

- Enforcement with cgroup-warden
  - Utilizes Systemd properties
  - cgroup version agnostic

  ```
  {"unit": "user-1000.slice", "property": {"name": "CPUQuotaPerSecUSec", "value": 1000000000000}}
  ```

https://arbiter.chpc.utah.edu/dashboard

Dashboard   Base Policy   Usage Policy   Violations   Log Out

Management

Status:

cgroup-agent instances up: 6

Last-Evaluated: 7 seconds ago

Run Arbiter Evaluation Loop:

[Evaluate]

Clean Violation History:

Before: 11 / 15 / 2024, 04 : 00 PM

[Clean]

Apply Property

Host

lonepeak1.chpc.utah.edu

Username

Property

CPU Quota (cores)

Value

0

[Apply Limit]

Recent Violations

Violation	Time
u1259516@scrubpeak1.chpc.utah.edu - Policy object (3)	8 seconds ago

View Usage

Host: All   Start Time: mm / dd / yyyy, -- : -- --   Step Size: 30   Seconds   [View Memory]

Username: u1259516   End Time: mm / dd / yyyy, -- : -- --   [View CPU]

Links and Contact

- Arbiter3
  - https://github.com/chpc-uofu/arbiter

- cgroup-warden
  - https://github.com/chpc-uofu/cgroup-warden

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