Proposing a Replacement for FreeBSD's powerd (Preview)

Or, how I tamed the fan of my notebook

Dominic Fandrey

Von Leitner-Institut für verteiltes Echtzeit-Java

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Definitions

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  - The fraction of CPU cycles not spent idle

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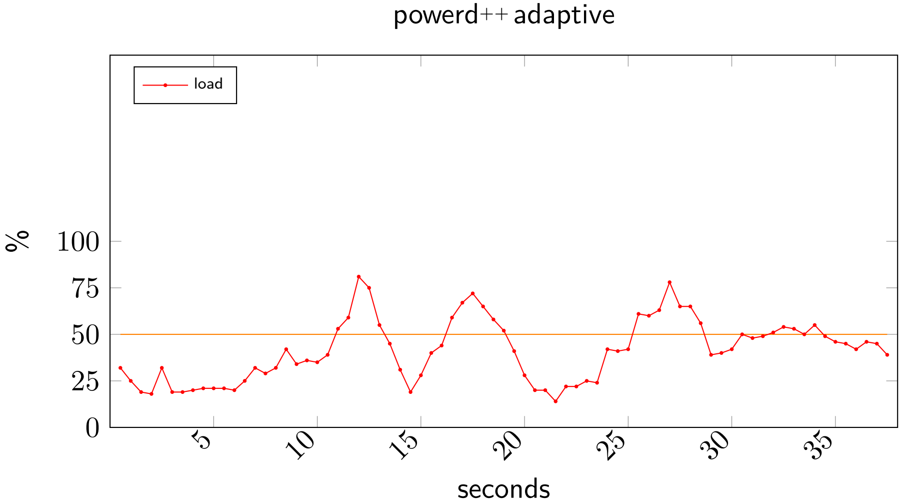
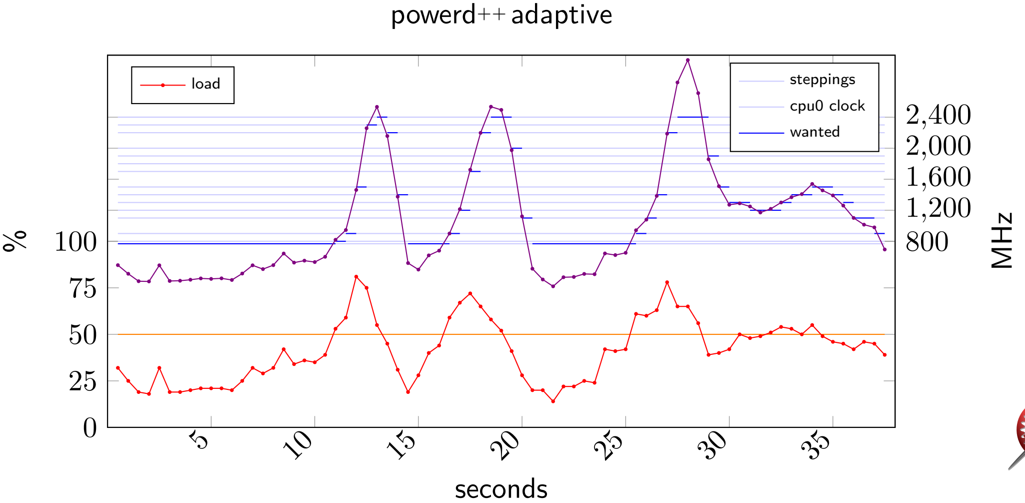
Definitions

- Load:
  - The fraction of CPU cycles not spent idle
- P-State:
  - Performance State, also frequently called stepping
  - A CPU mode of operation with a specific clock frequency and core voltage

CPU p-state control

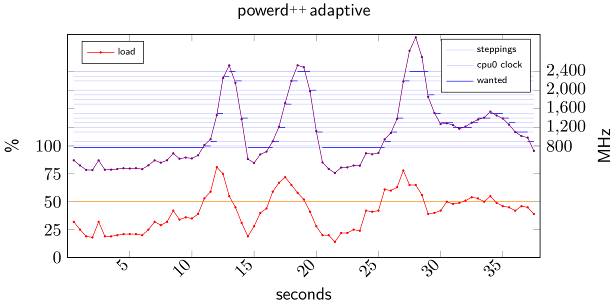


CPU p-state control



Why control p-state?

- Fan noise



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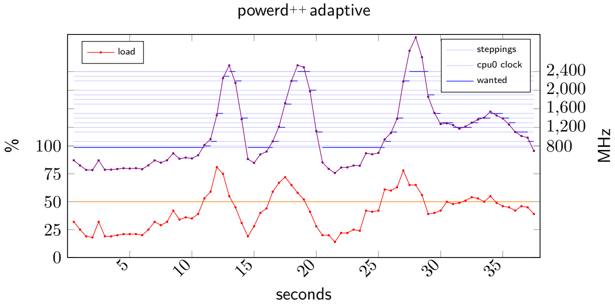

Why control p-state?

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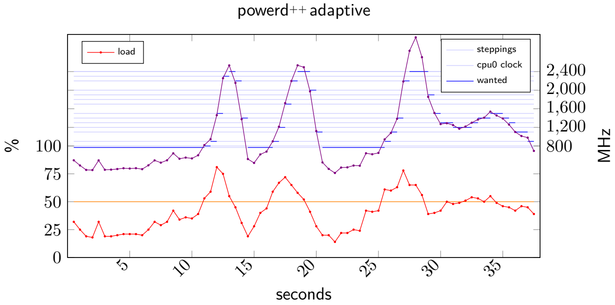

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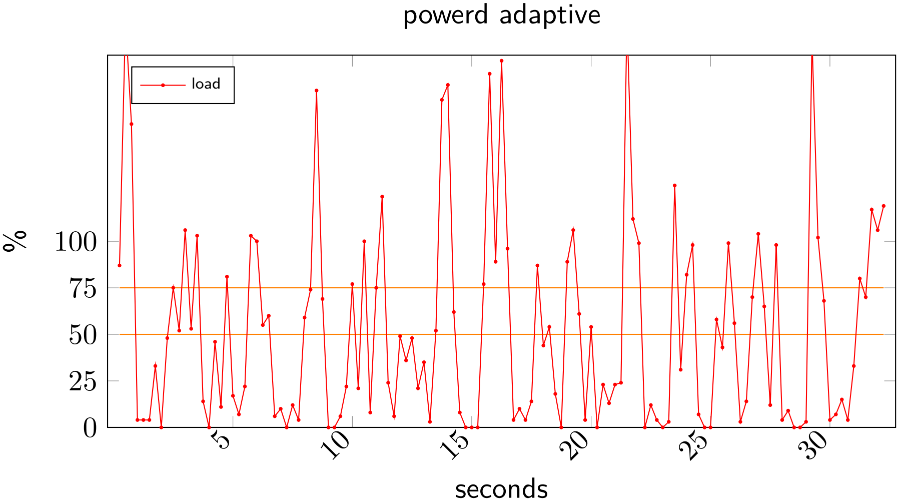

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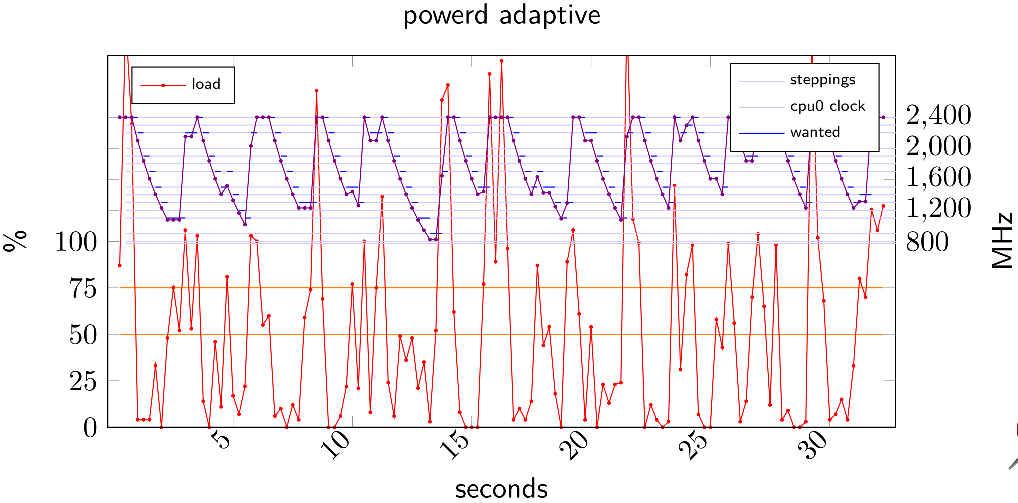

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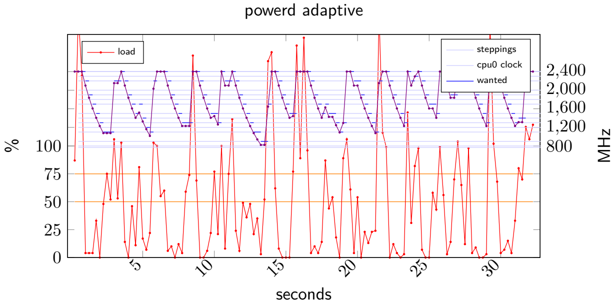
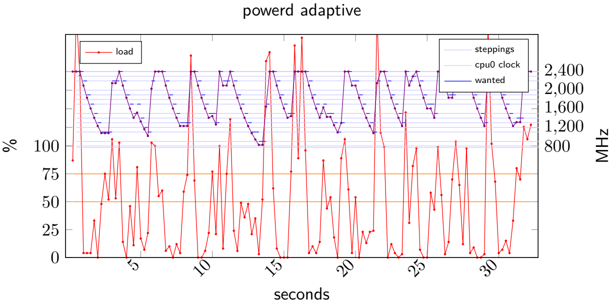


Why replace powerd?

- Broken load estimation
- Aggressive speeding



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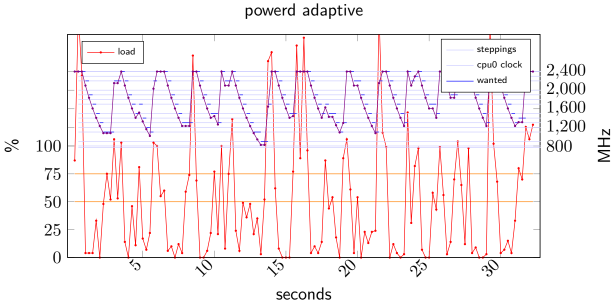

Why replace powerd?

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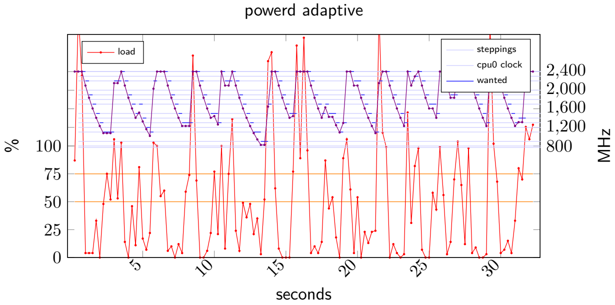
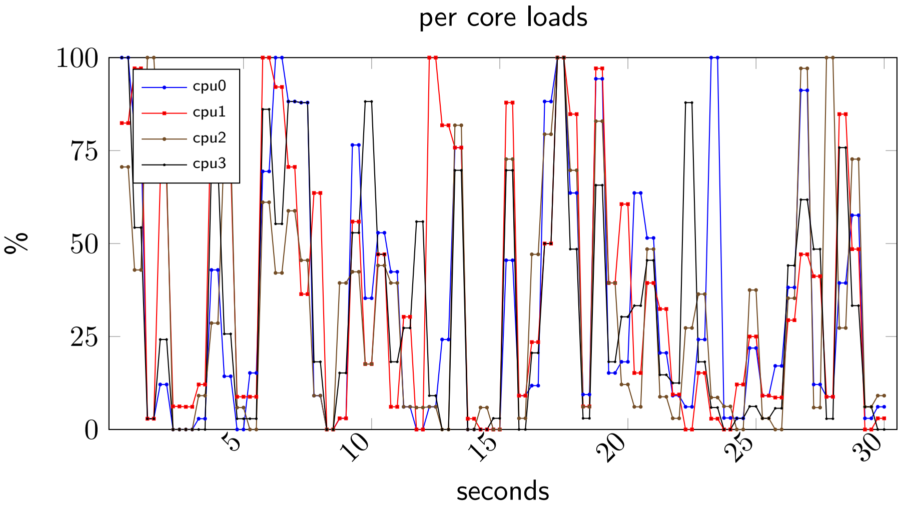
- Reluctant braking
- Excessive fan noise



Measuring loads



Measuring loads

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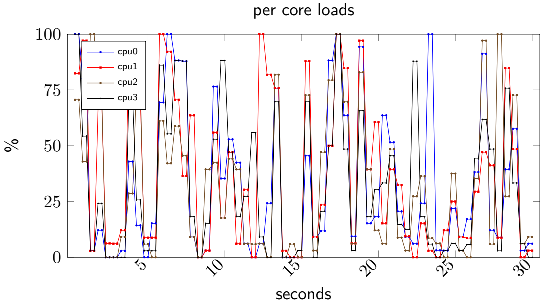

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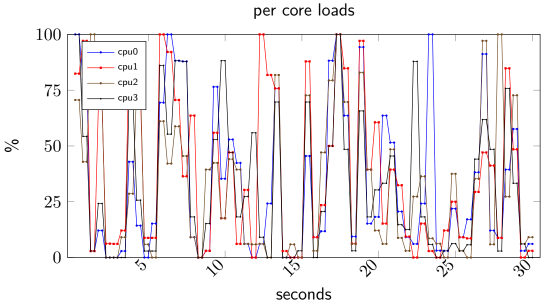

Measuring loads

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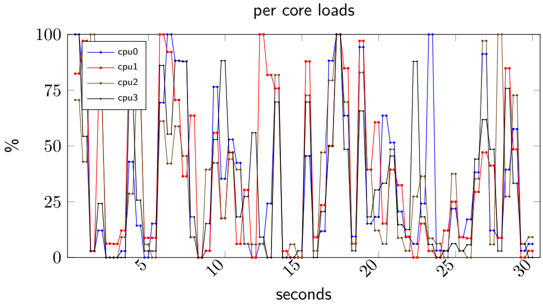
- Load saturates



Control algorithm

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Summary

powerd++ powerd

versus

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- Any granularity p-state changes

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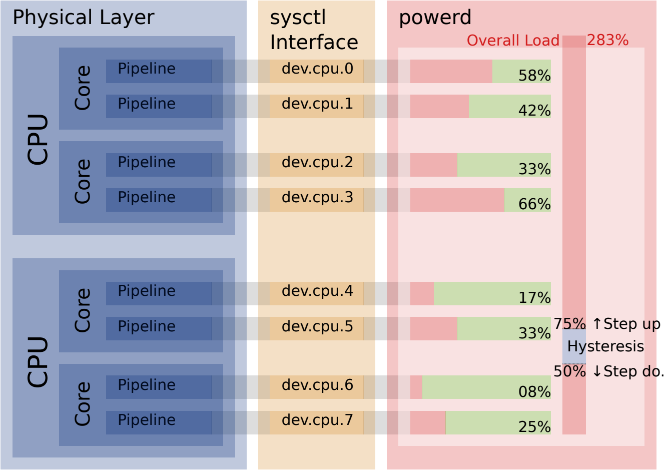
- Aggressively tuned for responsiveness
- Hard coded units `-M 1200`

Control algorithm (powerd)



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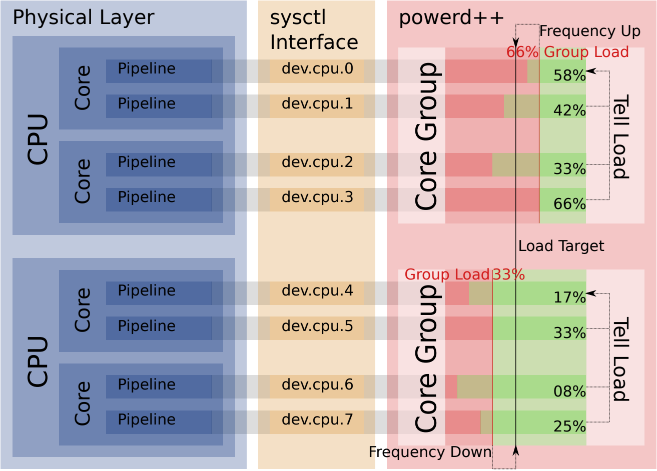
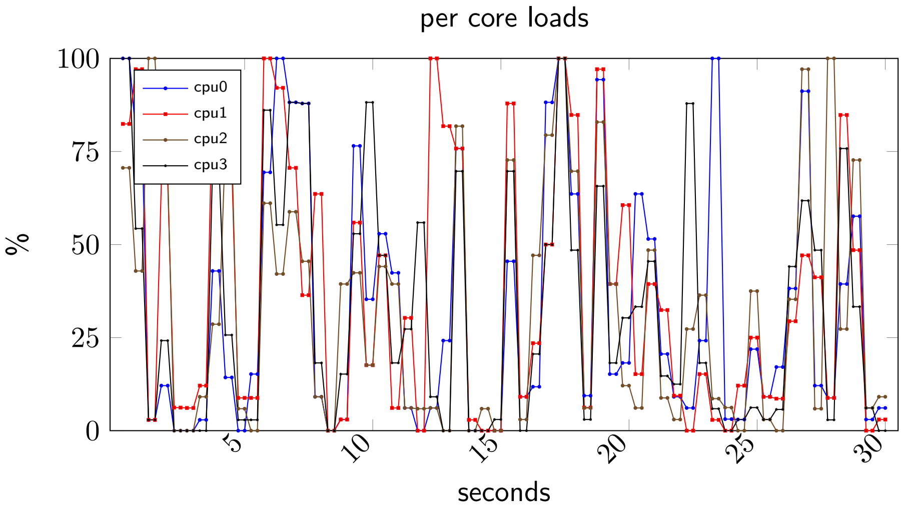


Dealing with signal noise



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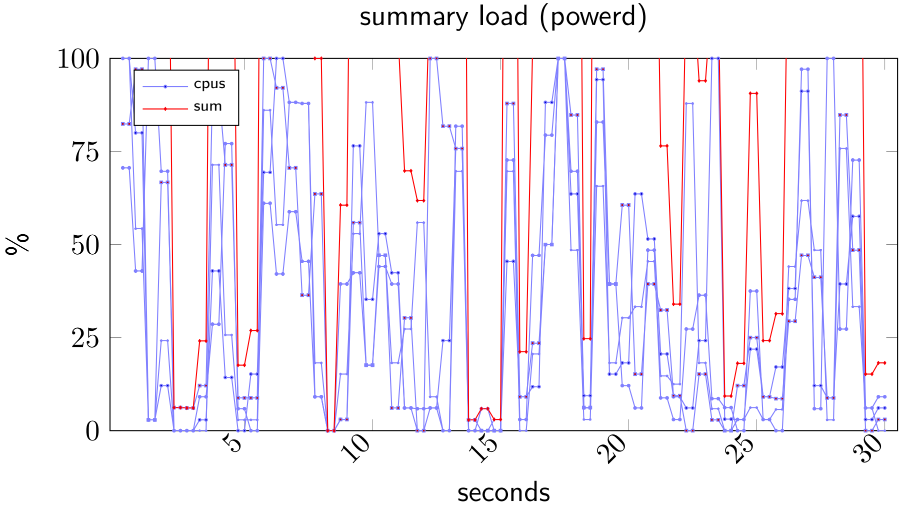

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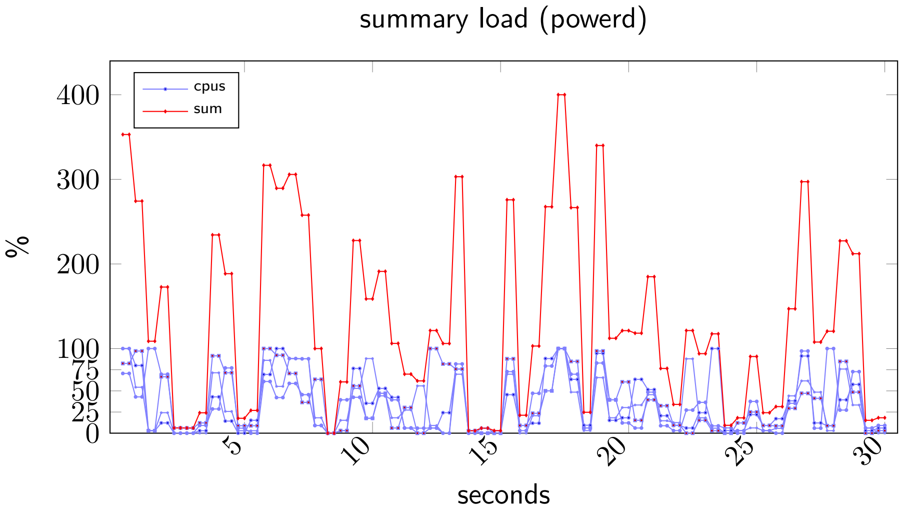

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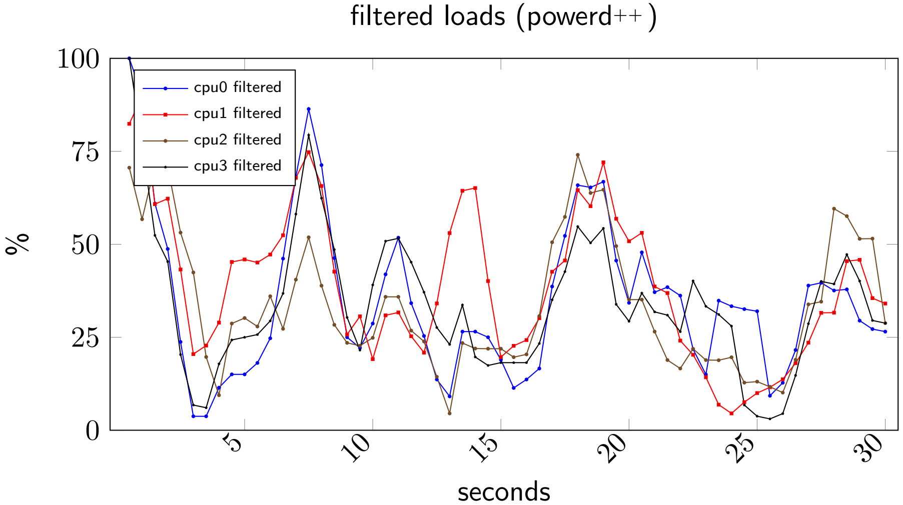

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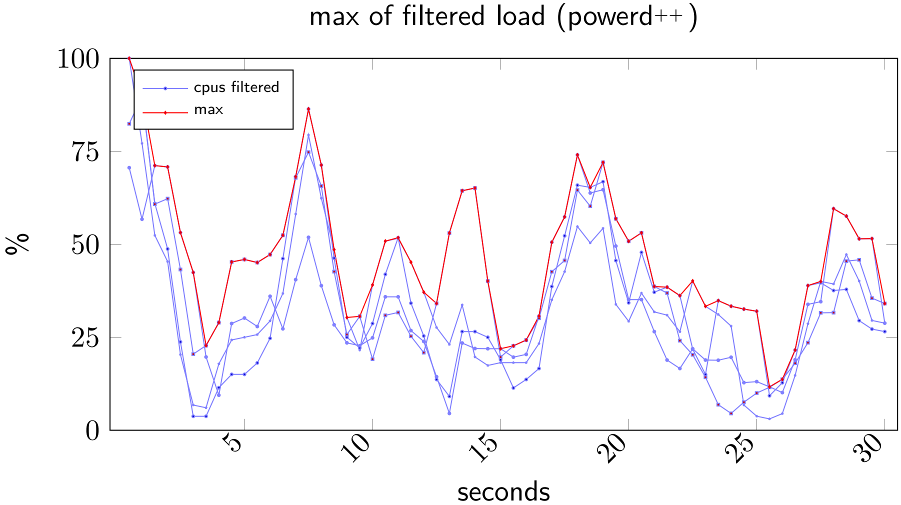

Solved problems

- Load signal noise

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- Lower sample rate, gliding average

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- Load signal noise
- Low multi core loads

- Lower sample rate, gliding average

Solved problems

- Load signal noise
- Low multi core loads

- Lower sample rate, gliding average
- Without breaking single core loads

Unsolved problems

- High frequency core hopping

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- This is rare

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- High frequency core hopping
- P-States that lie reduce accuracy
- `kern_clock.c` only supports global frequency changes

- This is rare
- Ignoring this works well enough
- This is fixable, but may break scheduling

\(-)/

Praise the sun!

`https://github.com/lonkamikaze/powerdxx`