

# Managing temperature in datacenters

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# Importance of temperature management

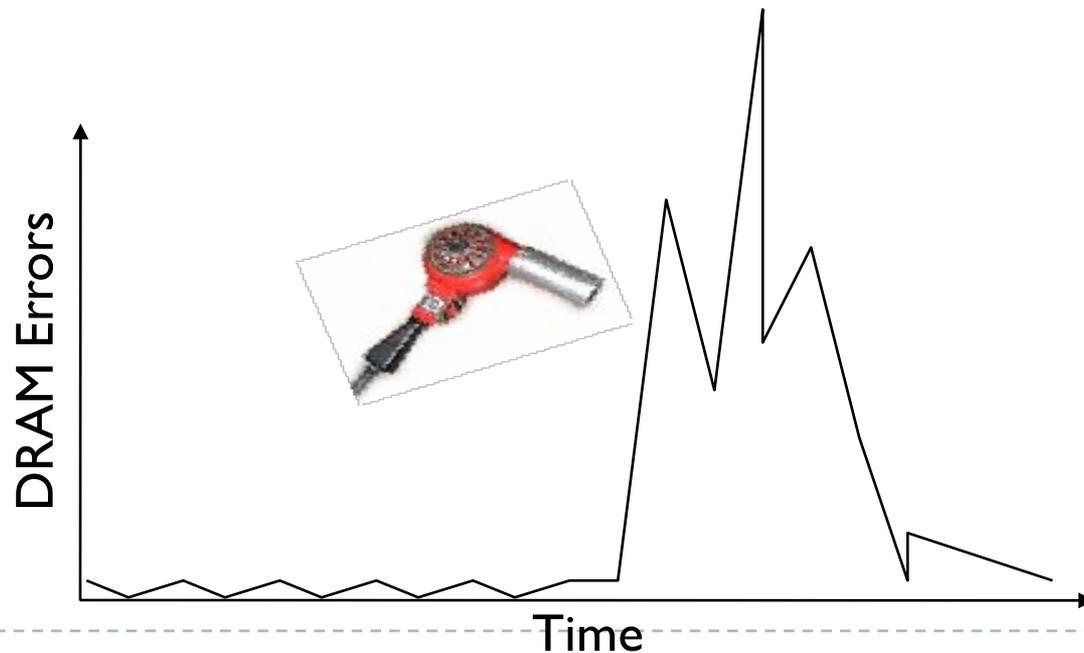
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- ▶ \$\$\$

- ▶ Estimated at a third of the total power budget

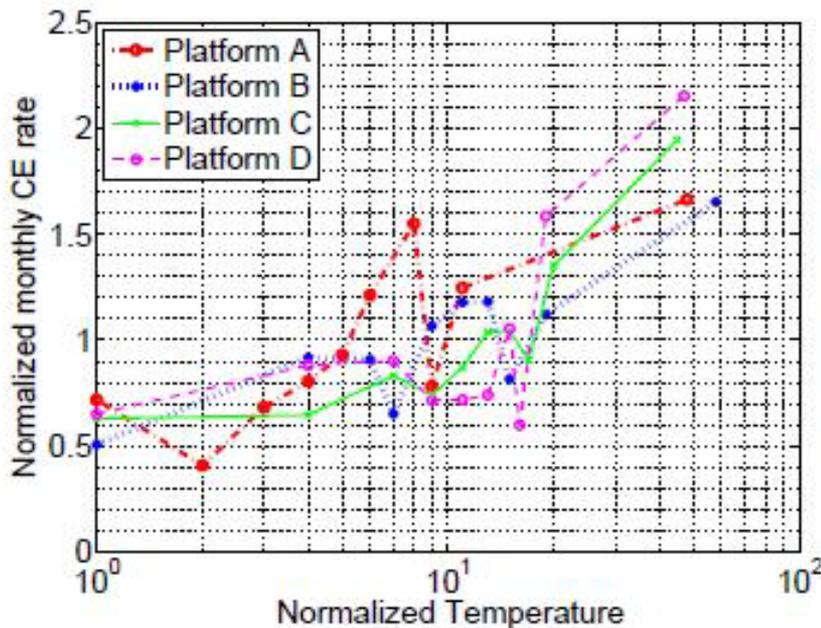
- ▶ Why?

- ▶ Concern about effect of temperature on component reliability



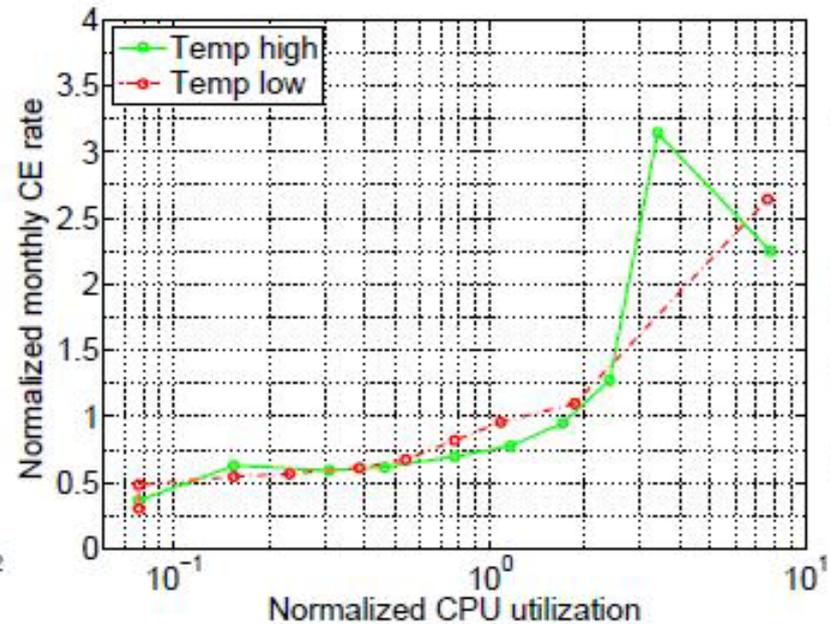
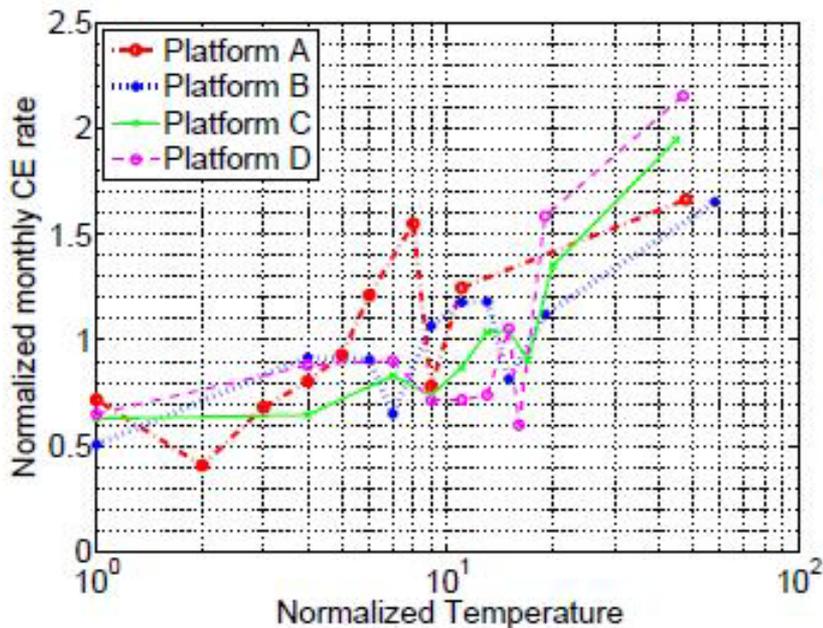
# Temperature and reliability in the field?

- ▶ Analyzed field data for two frequently replaced components: DRAM & hard disks



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- Surprisingly **weak effect**, when normalizing for util.

# Temperature and reliability in the field?

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▶ Some other preliminary results:

▶ Correlation with:

▶ DRAM errors

**No**

▶ DRAM component lifetime (time to replacement)

**No**

▶ Hard disk component lifetime (time to replacement)

**No**

▶ Hard disk errors (latent sector errors)

**MAYBE**



# What does this mean?

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- ▶ Need a better understanding of how to choose temperature setpoint
  - ▶ How is this done currently?
- ▶ “Increasing set point by one degree can reduce cost by 4%...”
- ▶ How does temperature affect different components and failure modes?
  - ▶ Does temperature affect mostly occurrence of soft or transient errors, rather than component lifetime?
  - ▶ Can we make systems more resilient against those errors?

