

The Future of Data Center Infrastructure



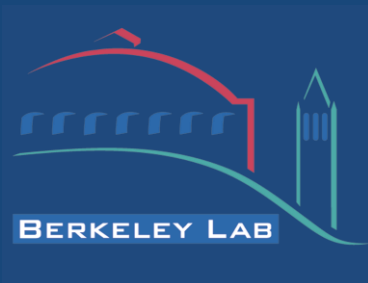
Henry Coles

Lawrence Berkeley National Laboratory
Environmental Energy Technologies Division

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Burlingame California

contact: hccoles@lbl.gov

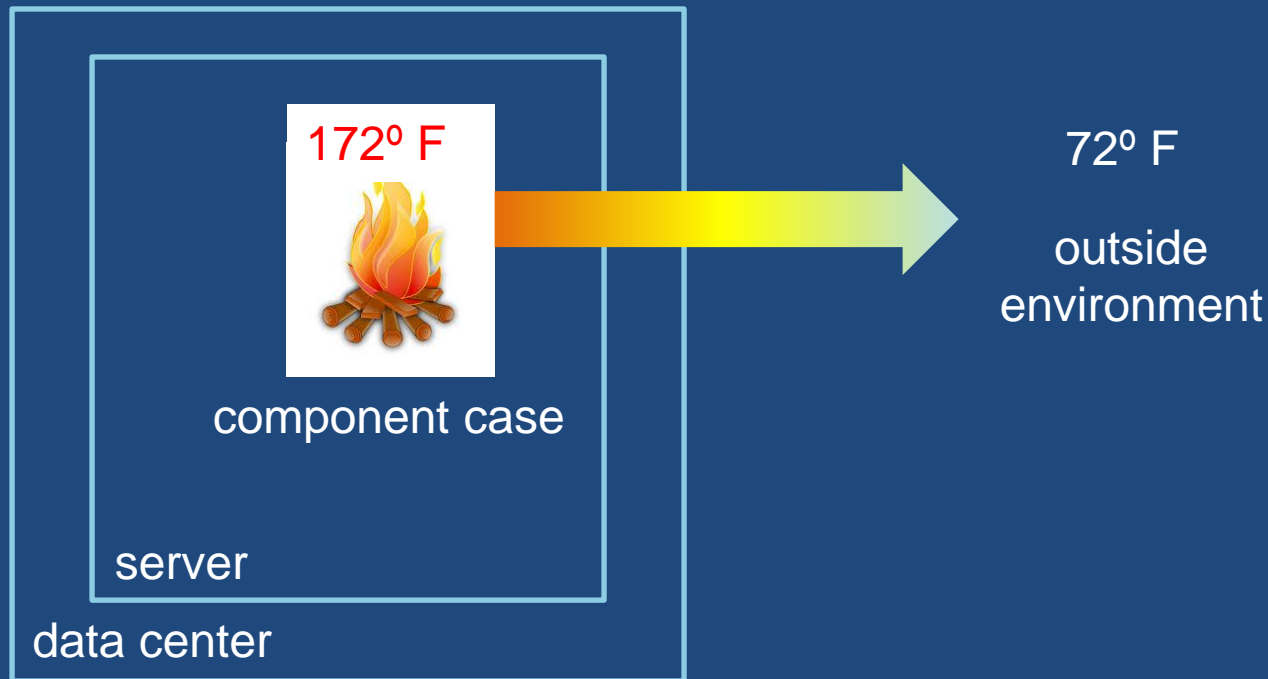


Subjects

- Cooling Infrastructure
- Electrical Power Infrastructure
(Facebook Open Compute Project, DC power)
- IT Utilization
(DCIM)
- Software Efficiency

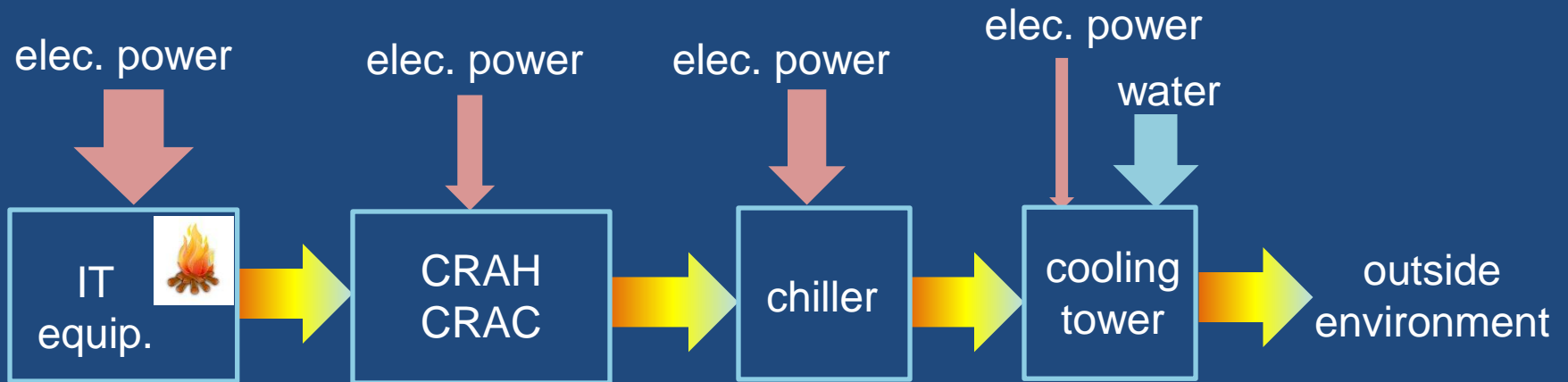
Cooling

Cooling a data center is simple, just let the heat go outside.



Conventional Technology

PUE: ~1.35-1.9+



What can we do?

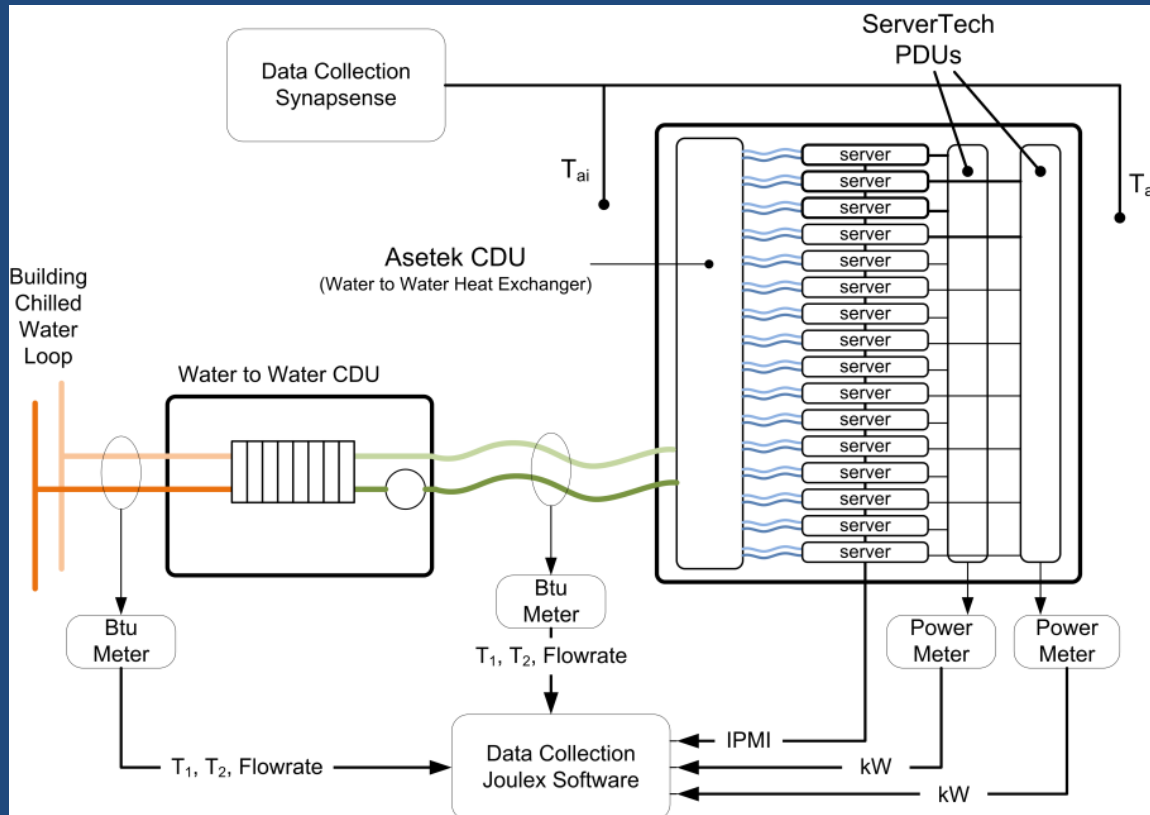
Newer Cooling Technology Examples

- Direct Liquid
- Free Air
- Immersion
- Improved Conventional

Direct Liquid

PUE: tbd

Asetek RackCDU



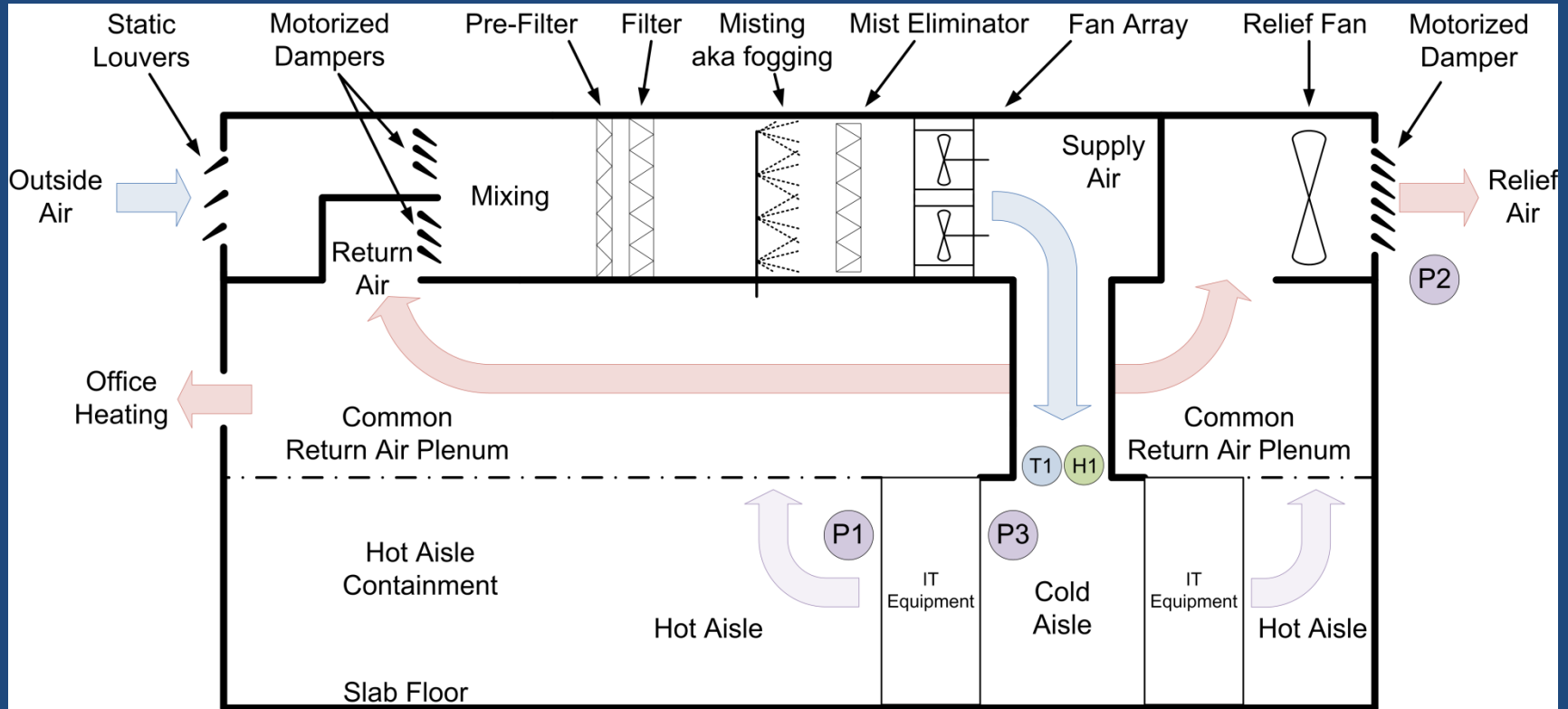
Test Setup



Free Air

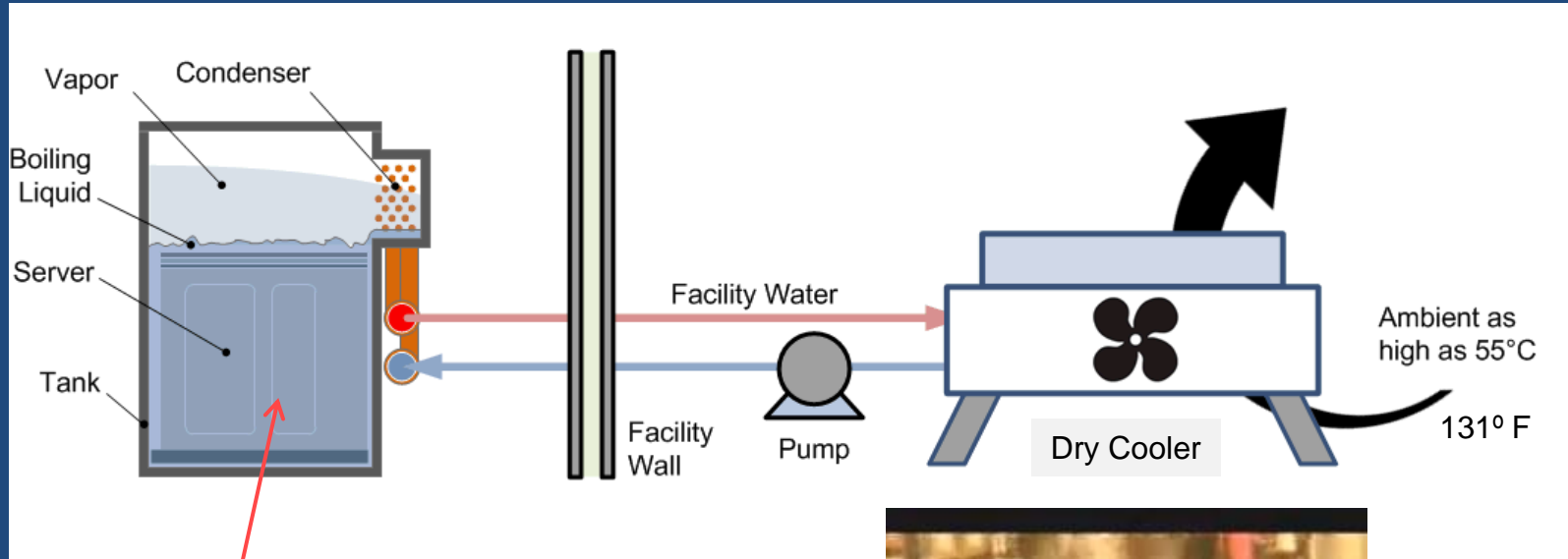
PUE: ~1.07

Facebook Prineville



Immersion

PUE: <1.1 ? tbd

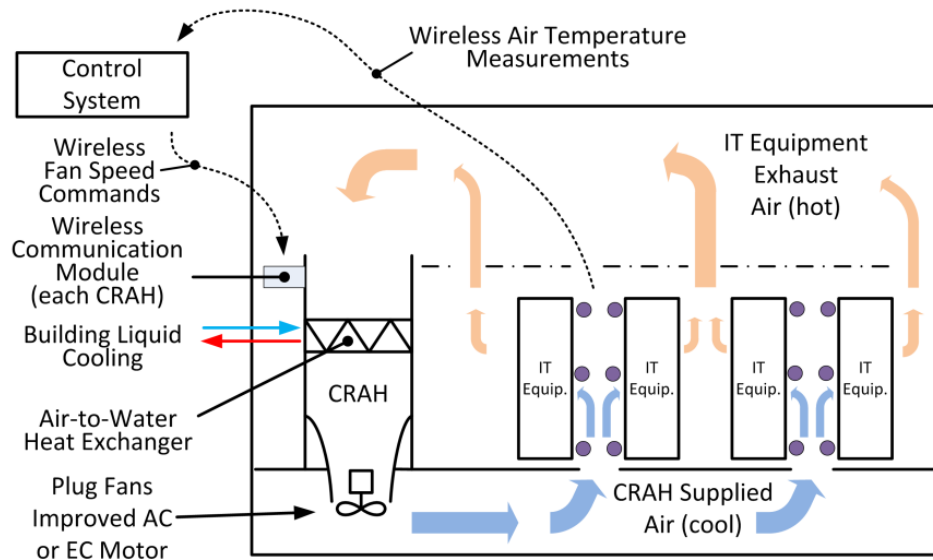


3M Novec 649 Fluid
Boiling Point 49° C (120° F)



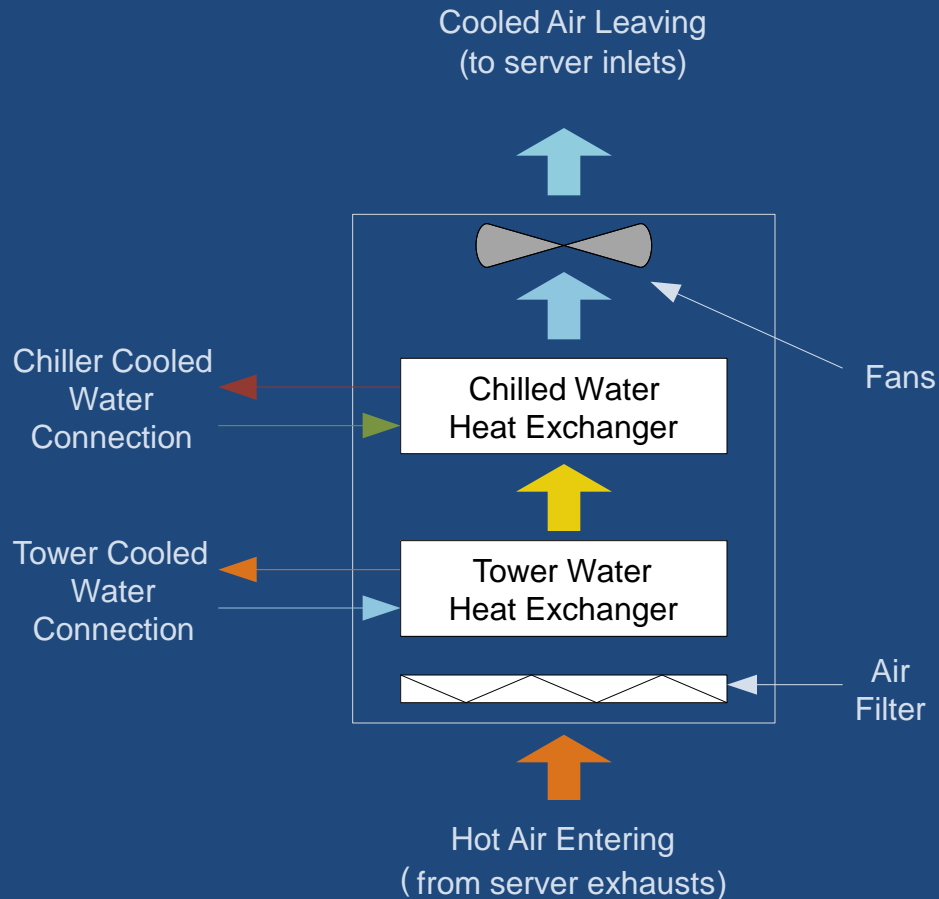
Improved Conventional

Vigilant CRAH Fan Speed Control with Fan Upgrade
CRAH Fan Power Consumption Reduced 66%
Site Energy Reduction 8%



Improved Conventional

Cooling COEE or Partial PUE (pPUE): 1.1-1.15



APC Dual Hex InRow™

Improved Conventional

What are these?



Conclusions

- Technologies to drastically reduce cooling infrastructure power consumption are now available.
- Alternate cooling technologies can provide significant reduction in water consumption.
- Cooling device innovation continues for conventional air cooled data centers
- Things are changing:
 - Allowable environmental limits are expanding
 - Heat transfer closer to heat source