Data Center Dynamics
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Harmonization of Open Standards:
Development of A Liquid Cooled Rack Specification

Agenda

- Introduction to Liquid Cooling and the Open Specification Development
- Introductory Remarks from each Participant
- Interactive Discussion

International Harmonization for Greater Market Pull

- Target standards
  - Scorpio
  - Open Compute Project (OCP)
- Start with non-existing specifications
  - Warm water liquid cooled rack
  - “High” voltage DC power
  - Environmental conditions

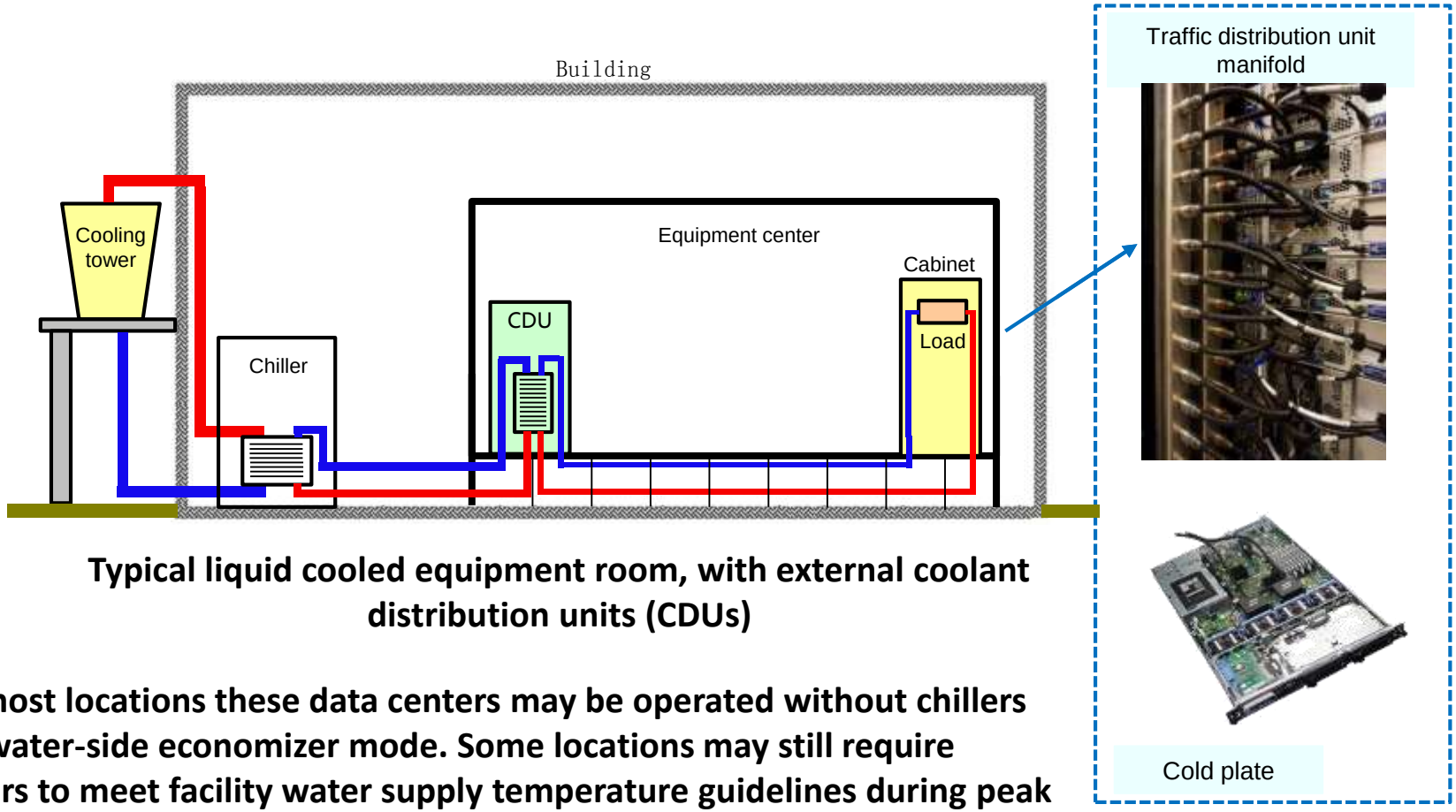
Liquid Cooled Rack Standard

- While liquid cooling potential is understood, uptake is slow
- Most solutions are unique and proprietary
- Needed:
  - Multi-source solution
  - Reusable rack infrastructure
- Users can drive faster technology development and adoption

Benefits of Liquid Cooling

- Higher compute densities
- Higher efficiency
  - Heat removal
  - Transport energy
  - cooling plant
  - Increased economizer hours
  - Potential use of waste heat

Liquid Cooling Solution



Typical liquid cooled equipment room, with external coolant distribution units (CDUs)

For most locations these data centers may be operated without chillers in a water-side economizer mode. Some locations may still require chillers to meet facility water supply temperature guidelines during peak (i.e., design) ambient conditions for a relatively short period of time.

International Open Data Center Specifications

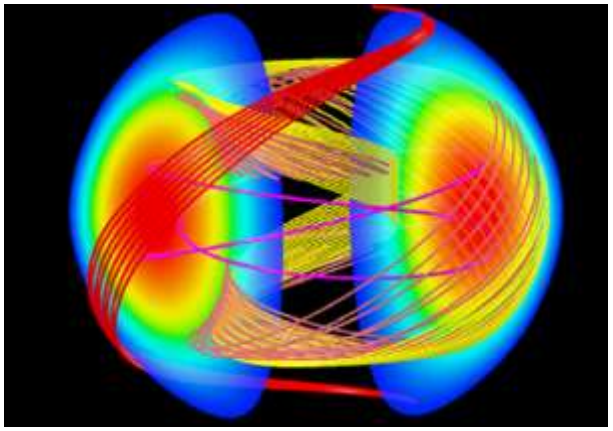
- Target Organizations:
  - The Open Compute Project (OCP) – US
  - Scorpio Project – China
- Collaborators:
  - Facebook
  - Google
  - Intel
  - Microsoft
  - Baidu
  - Alibaba
  - Tencent

Goal for Liquid Cooled Rack Specifications

- A liquid cooled rack specification that could accommodate multiple vendors and provide an infrastructure for multiple refresh cycles with a variety of liquid cooled servers/suppliers

Lawrence Berkeley National Laboratory (LBNL)

- Operates large systems along with legacy equipment



- We also research energy-efficiency opportunities and work on various deployment programs

LBNL Case Study

- Super computers are already liquid cooled (each uniquely) but growing need in smaller HPC clusters that use more conventional compontents (e.g. racks)
- 10 Year Master Plan for legacy data center
- A transition back to liquid cooling

Zone 1 Heat Collection Solution

Legacy (ASHRAE A1: 80.6 degF operating, 89.6 deg F max):

- Air cooled
- Raised floor
- Partial hot aisle containment
- Existing AHU and CRAC units

Upsite Technologies, Inc

Zone 2 Heat Collection Solution

High density (ASHRAE A3: 80.6 deg F operating, **104 deg F max)**:

- Passive and active rear door heat exchangers
  – Selection based on rack load
- Rear doors supplied with 66 deg F operating, 84 deg F max water temp

Passive Rear Door Heat Exchanger

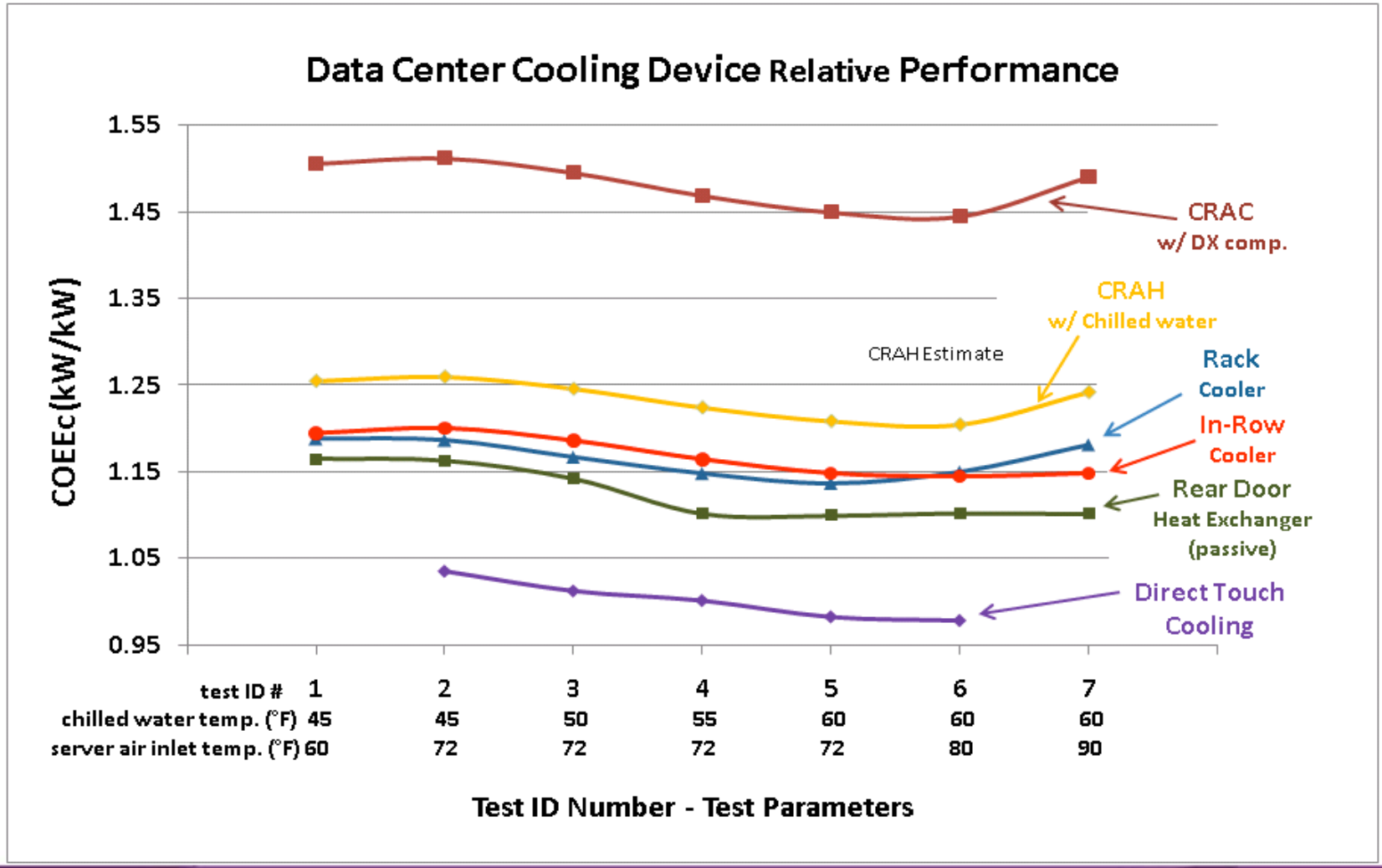
Rear Door Heat Exchanger w/ Fan Assist

Zone 3 Heat Collection Solution

Super high density direct liquid to chip cooled:

- Need for liquid cooling rack standard
- Warmer water can be used, e.g. using effluent from Zone 2 or water cooled by outside air

“Chill-Off 2” Evaluation of Liquid Cooling Solutions



Websites

U.S.: https://datacenters.lbl.gov/industry-driving-harmonization-international-data

China: http://www.ictlce.com/jeecms/kfjs.jhtml