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Introducing advanced cooling solutions into existing data centers

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[CE]

Introducing advanced cooling solutions into existing data centers

Design considerations and, operational and performance learnings

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Driving Factors

ADVANCED COOLING FACILITIES

Component power and density pushing limits of air-cooling.

AALC is an enabling technology. Facility water integration may not be as rapid as component power/cooling trends.

Lower cost solution to retrofitting air-cooled data centers with facility water.

Higher efficiency than air cooling for similar power density.

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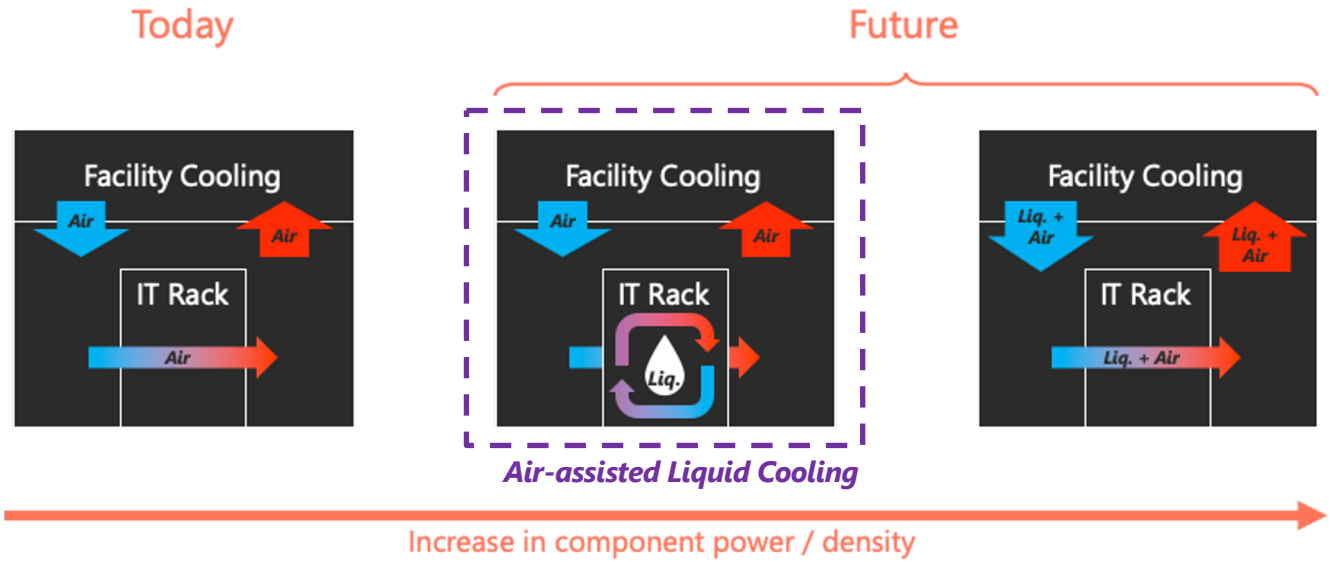
Stretching Limits of Air Cooling

ADVANCED COOLING FACILITIES

Extends life of air-cooled facilities and adds optionality for DC owners



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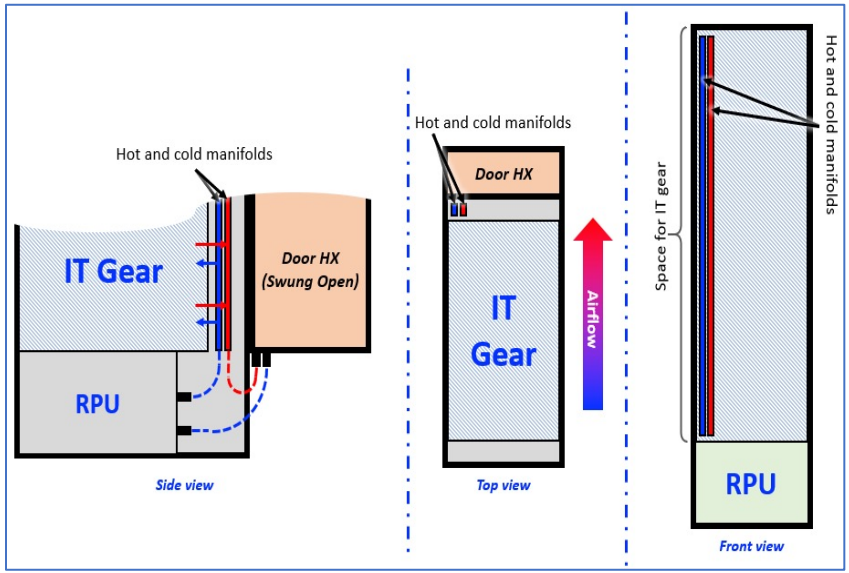
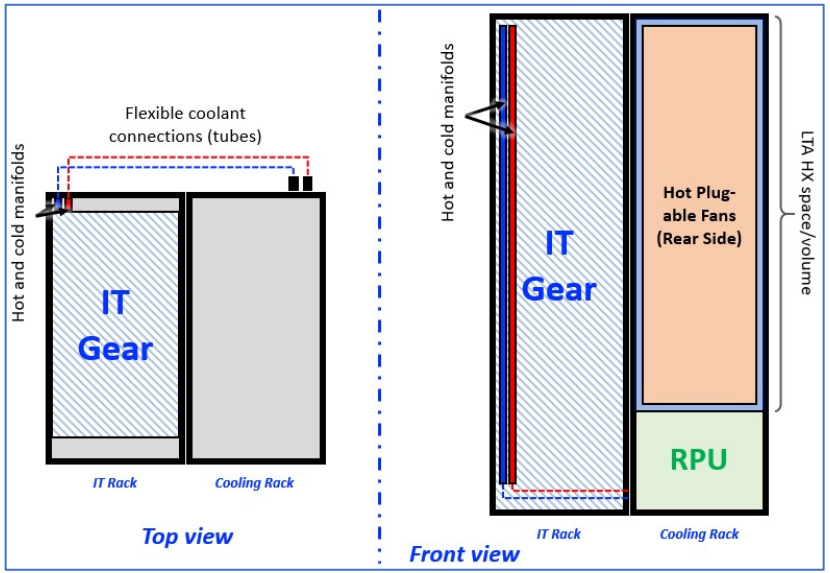
Rack-level Deployment Approaches

ADVANCED COOLING FACILITIES

Door Heat Exchanger



Side Car Heat Exchanger



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Why two solutions?

ADVANCED COOLING FACILITIES

Door Heat Exchanger

Pros

- Compact and self-contained
- Squeeze more racks into data center
- Common air flow for IT and door HX

Cons

- 4U space lost to RPU
- Lower cooling capacity than side car
- Custom mounting brackets maybe needed

Side Car Heat Exchanger

Pros

- Higher cooling capacity
- Easier to deploy – rack and roll
- Rack space for additional blades not

Cons

- Side car takes up room

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Operational Learnings

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RDHx Challenges (Rear-door)

ADVANCED COOLING FACILITIES

Category	Learning	Challenge
System assembly	RDHx is heavy, should be designed with assembly in mind.	With a mass of < 150 kg (filled), should not be installed without mechanical aid
Characterization	Server fans need to produce a certain amount of pressure or fans need to communicate with RDHx to set cooling requirements	Each server and fan profile will affect characterization
Serviceability	Challenging with mass and accessing hot aisle	Field replacement of RDHx
Maintenance	Opening rear door for maintenance reduces cooling capacity for rack	

RDHx Learning (Rear-door)

ADVANCED COOLING FACILITIES

- Once assembled, can handle up to 24kW with an OTS RDHx. Optimized can hit > 40kW
- Efficient utilization of floor space
- Enables higher density servers and higher TDP chips.
- All airflow that moves through the servers goes through the HEX

Adjacent Rack HEX Challenges

ADVANCED COOLING FACILITIES

Category	Learnings
System assembly	Designed to work with ORv3 rack and power. Optimized solution could be built without these constraints.
Characterization	Adequate airflow management / balancing between IT gear and cooling racks.
Serviceability	Easier to service in the field
Maintenance	Actions on either rack should not have influence on the other rack

Adjacent Rack Learning

ADVANCED COOLING FACILITIES

- Easy to rack and roll
- Requires no changes to the IT rack for cooling
- Can support multiple racks of IT gear
- Achieved higher than expected performance

Future steps for qualifying AALC

ADVANCED COOLING FACILITIES

- System integrator review to deploy at scale
- Adequate airflow management / balancing between IT gear and cooling racks
- Performance / efficiency optimization to hit 40kW cooling

RPU Spec Overview

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Why of the spec

ADVANCED COOLING FACILITIES

STANDARDIZATION AND CONSISTENCY

INTEROPERABILITY BETWEEN VENDORS

WIDER ADOPTION AND BETTER ECOSYSTEM

OCP Specification Outline

ADVANCED COOLING FACILITIES

1. Scope
2. Terminology
3. Overview
4. RPU Requirements
   - Physical, Performances, Monitoring, and Operational
5. Sensor Requirements
   - Sensor List, Control Scheme, Alarms and Field Safety
6. Environmental Conditions
7. Serviceability and Operational Impact
   - Touch points, Pump, Filtration, Loading Force, LED Standard
8. Compliance and Safety
   - ESD, Flame Rating, Noise, Vibe & Shock
9. Test Requirements
   - Leaks, Functional Testing and Calibration, Burn-in, Test-to-Failure
10. Long-term Reliability

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OCP Specification Preview

- 4RU chassis designed to fit in 19" rack
- Adapter frame for Open Rack V2 and V3
- DC and AC input variants
- N+1 redundancy for all moving parts is a must
- Consumes ≤5% of rack IT power (including liquid-to air HX)
- Controls and monitors the liquid-to-air HX
- Standardized controls and reporting interface for rack level / DCIM

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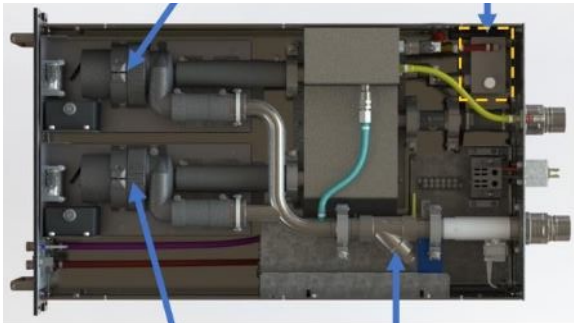
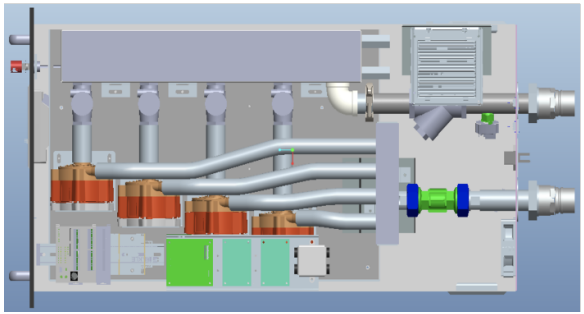
Photos of Prototype Builds

ADVANCED COOLING FACILITIES

CoolIT RPU



Delta RPU



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Photos of Prototype Builds

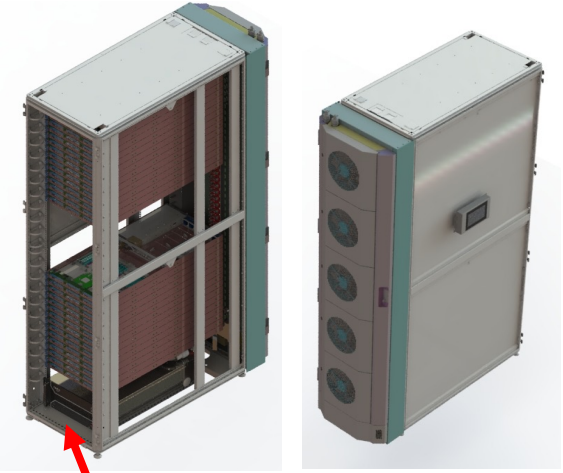
ADVANCED COOLING FACILITIES

CoolIT hot-swappable pump RPU

Prototype Implementations

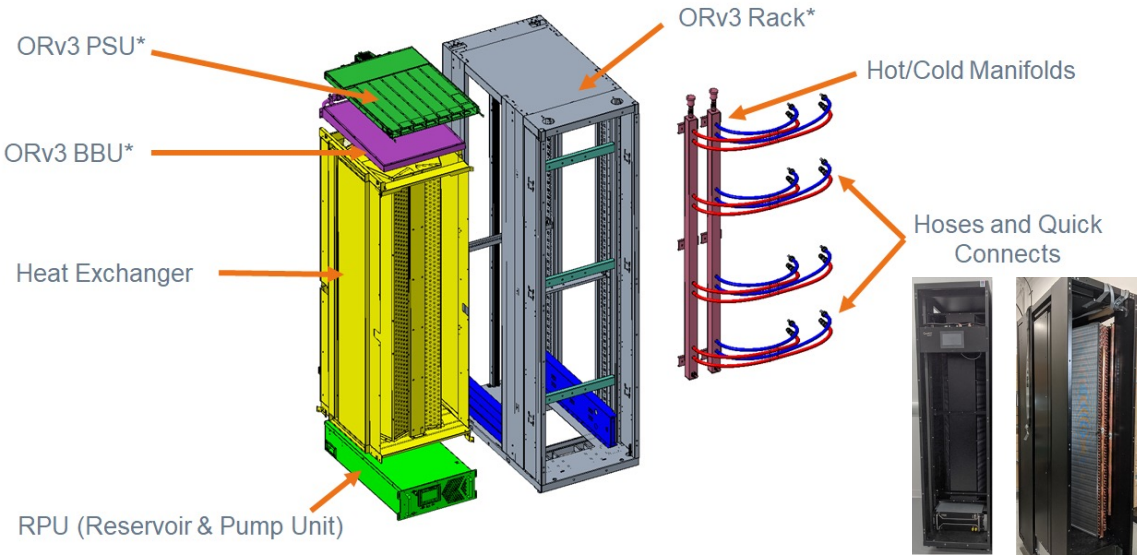
ADVANCED COOLING FACILITIES

RPU + RDHx



Reservoir and Pumping Unit

Adjacent Side Car Hx



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Next Steps for Working Committee

- Signed final spec agreement for RPU
- Incubation committee submission and approval
- Side-car and RDHx specs

Join the mailing lists:

Advanced Cooling Solution: https://ocp-all.groups.io/g/OCP-ACS

Door Heat Exchanger: https://ocp-all.groups.io/g/OCP-ACS-Door-Heat-Exchanger

Cold Plate Work Stream: https://ocp-all.groups.io/g/OCP-ACS-Cold-Plate

Immersion Work Stream: https://ocp-all.groups.io/g/OCP-ACS-Immersion-Cooling

Project Wikis:

Rack & Power

ACS Door HX

ACS Cold Plate

ACS Immersion

Open Discussion