Passive Liquid Cooling enables a carbon free 350kW Modular Data Centre

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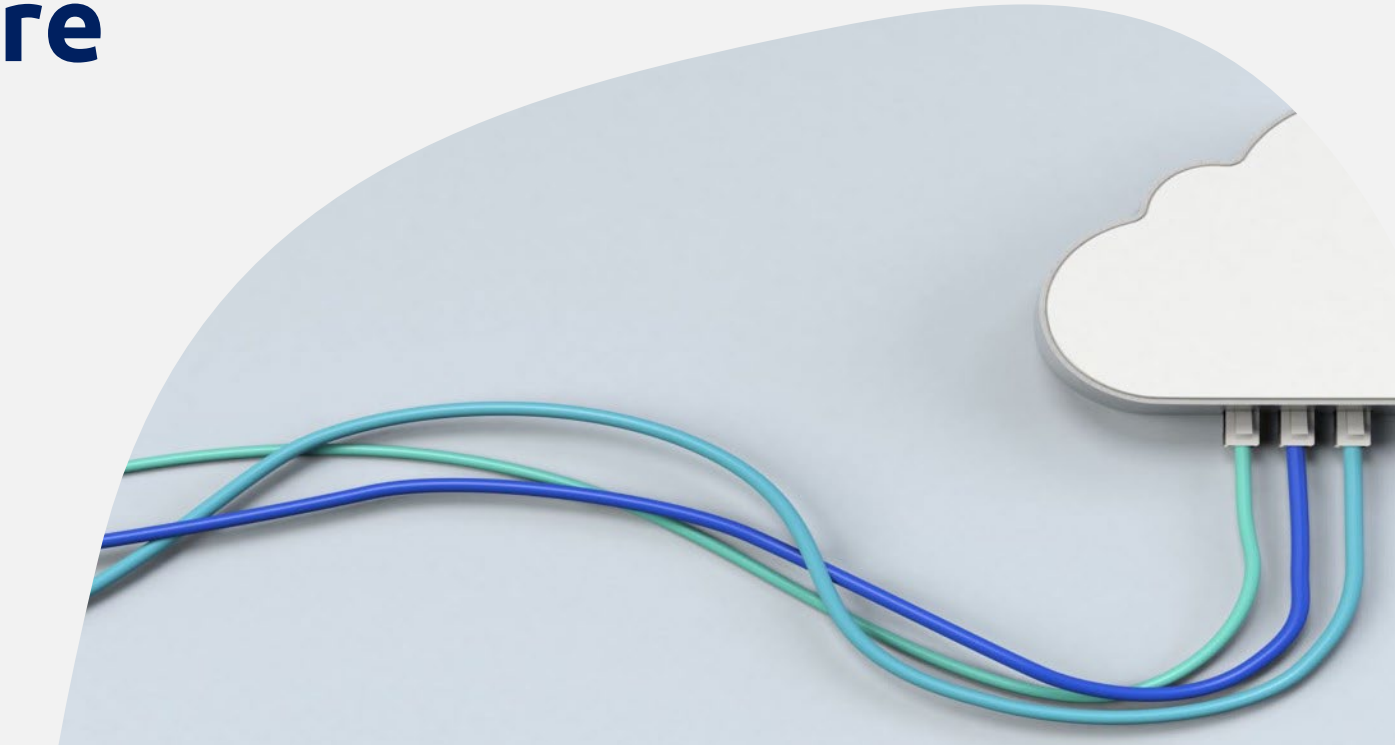
Data Centre World, London



What is **OCP**?

The **O**pen **C**ompute **P**roject Foundation
is a non profit open source hardware community
which since its formation in 2011 has been disrupting
the 20th Century Data Century Industry

www.opencompute.org

Technology Contribution Process

Member makes a contribution

Including technical documents

Reviewed by community

Voted by incubation committee

Posted on opencompute.org

Available to the public

OCP Technology Principles

Efficiency - performance, cost, conversion & cooling

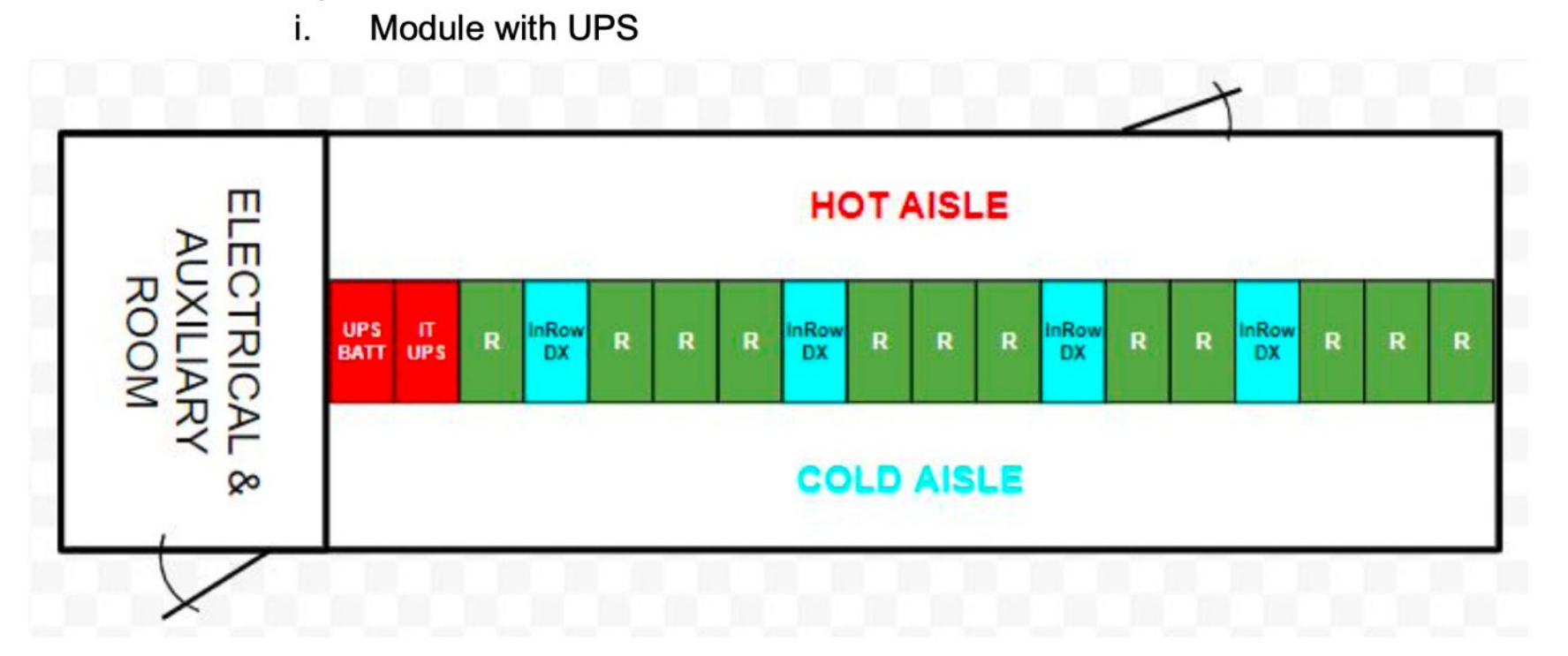
Scale out - Tool-less design, OCP compliant management tools and documentation

Openness - Open Source, Open Interface, OCP Compatible

Impact - Efficiency gains, new technology, leverage/empower prior contributions and enhance supply chain

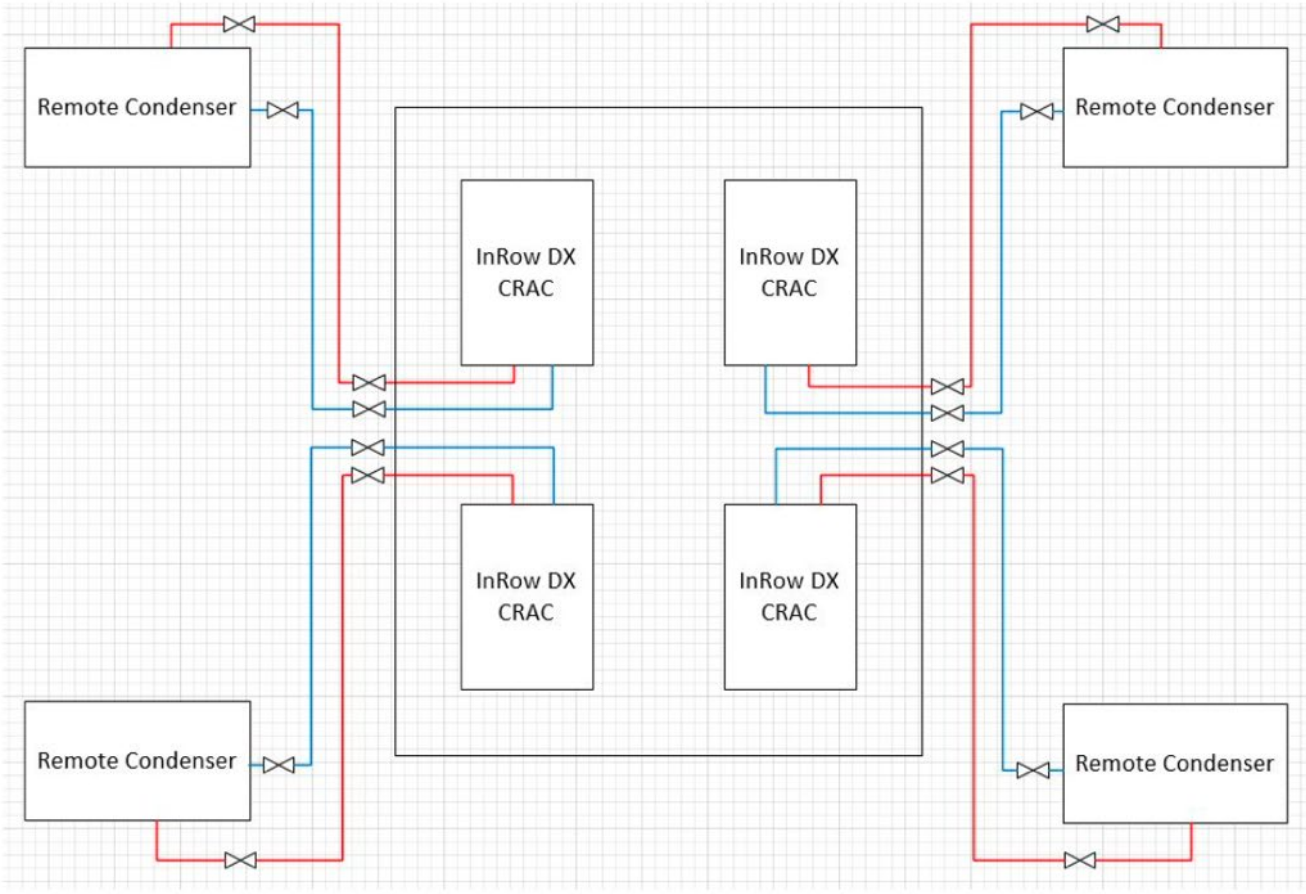
Modular Data Center Air cooled 90kW

12 racks / 250 servers



In-row DX cooling

3. Cooling
    a. Piping diagram



In-row DX cooling

Ambient air

-18…+34°C

Condenser

4 kW

140 kW

In-row

45 kW

Air for servers

24°C

34°C

90 kW

In-row DX cooling



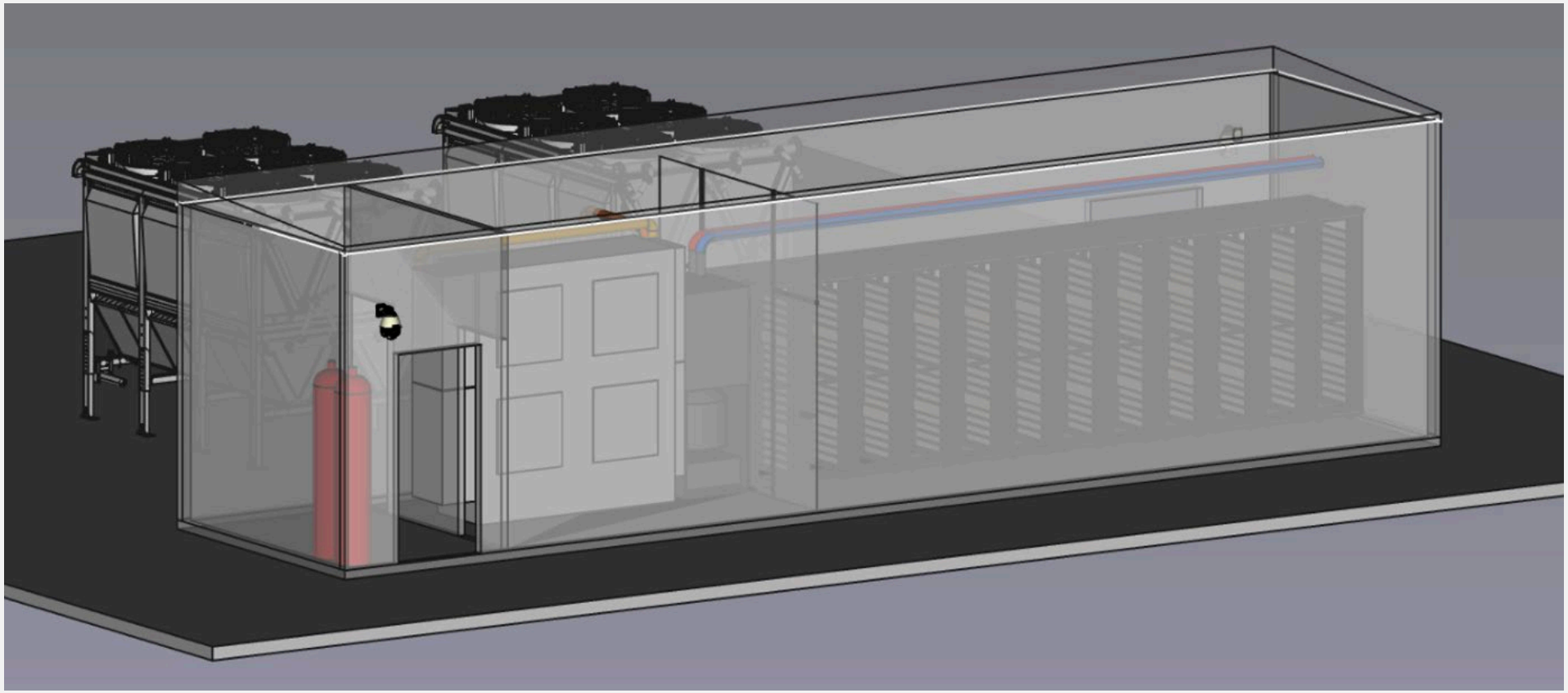

	Condenser	In-row	Servers	UPS	Total
kW	4	45	90	5	144
Hours	8760	8760	8760	8760	
MWh	30	347	**788**	41	**1206**

$$\mathbf{PUE} = \frac{\text{Total energy}}{\text{IT energy}} = \frac{1206}{788} = 1.53$$

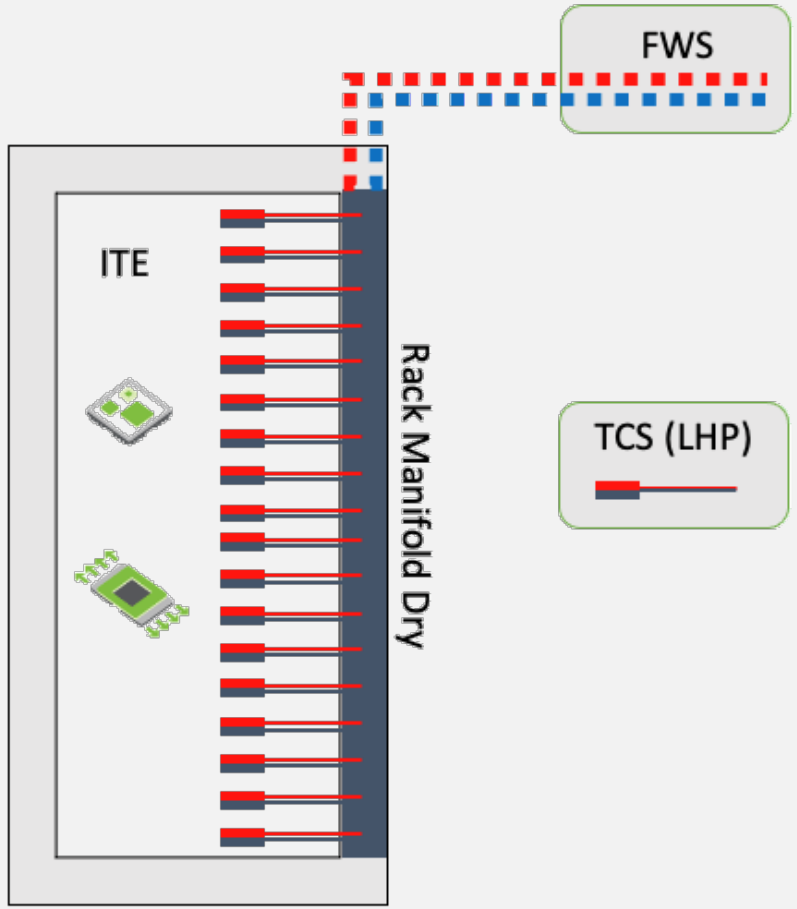
Frigel
Intelligent Process Cooling

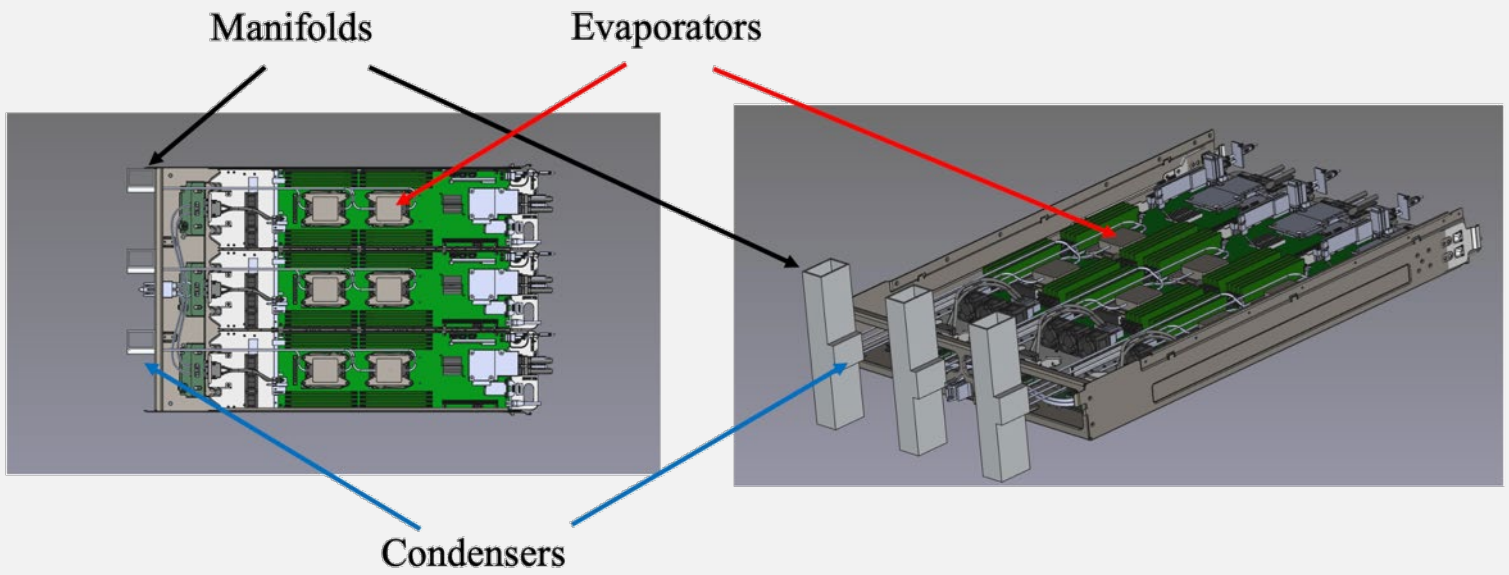
Thermocon LHP

Passive liquid cooled Modular Data Center

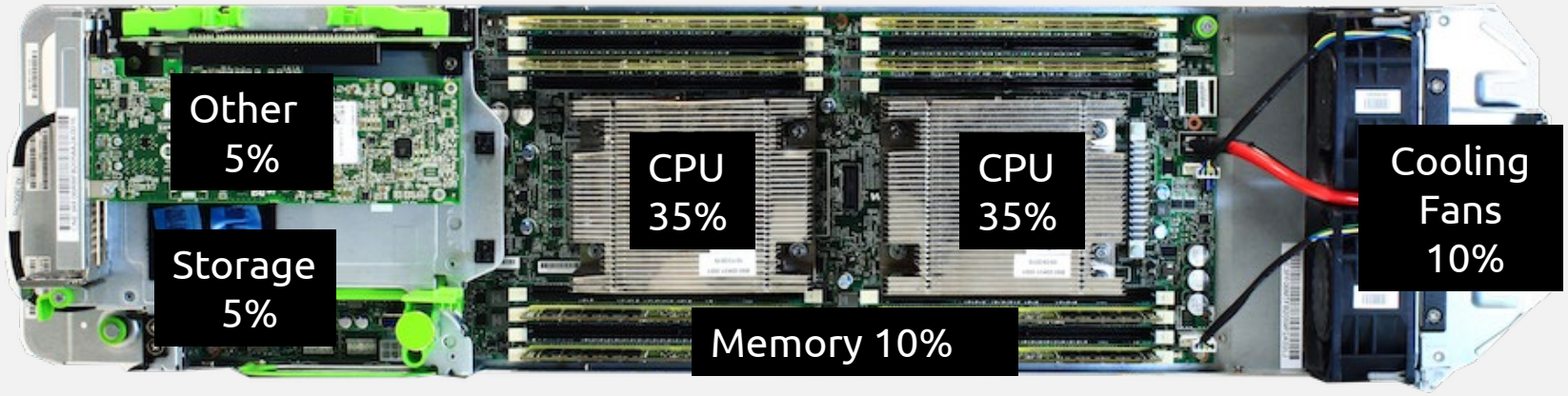


Passive liquid cooled OCP servers





What is the server energy?

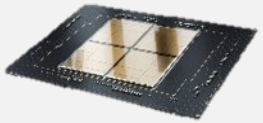


What is the server energy?

10% of server energy

90% of server energy

CPU 70%

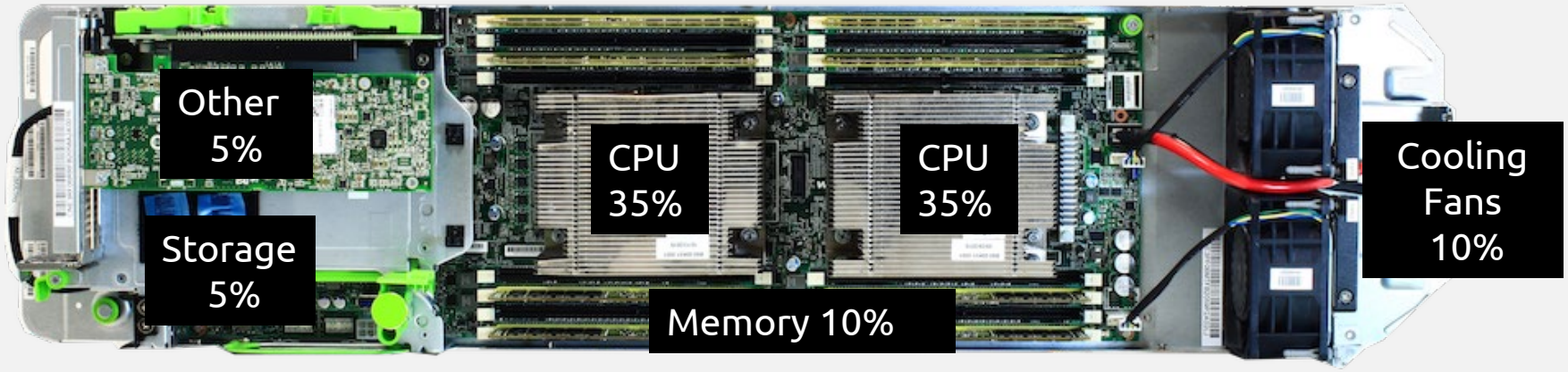


Memory 10%

Storage 5%

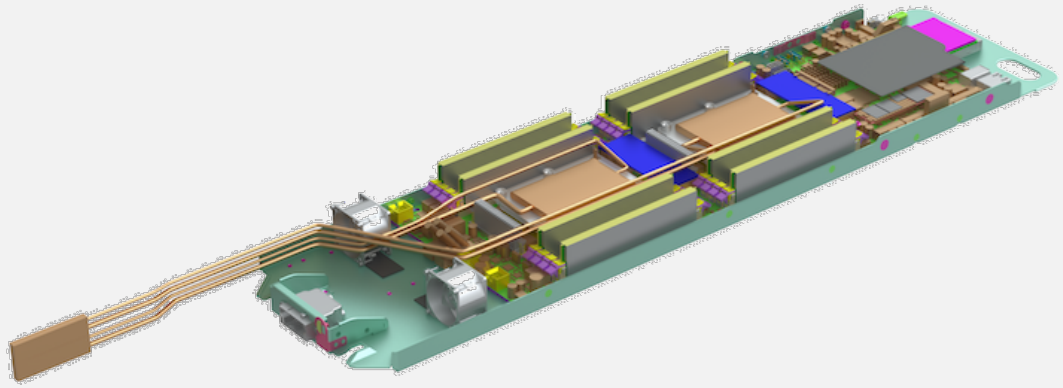
Other 5%

Is it possible to reduce the server energy?



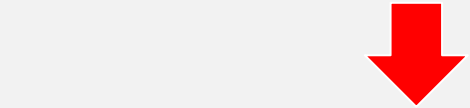
Fans power reduction of 70%

Replacement of the heat sink with the interface



Fans power reduction of 70%

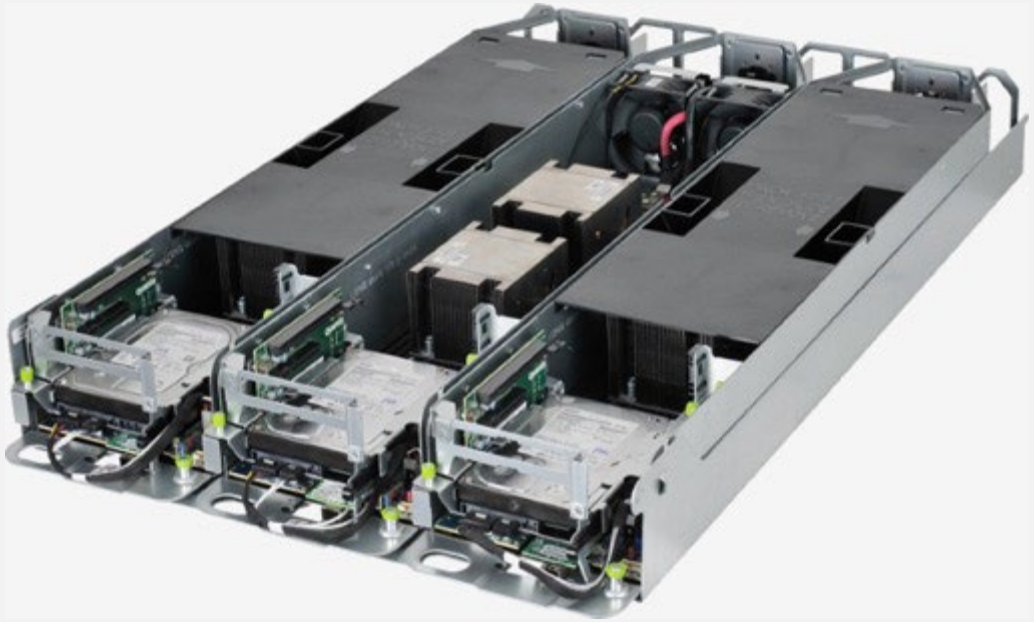
10% of server energy



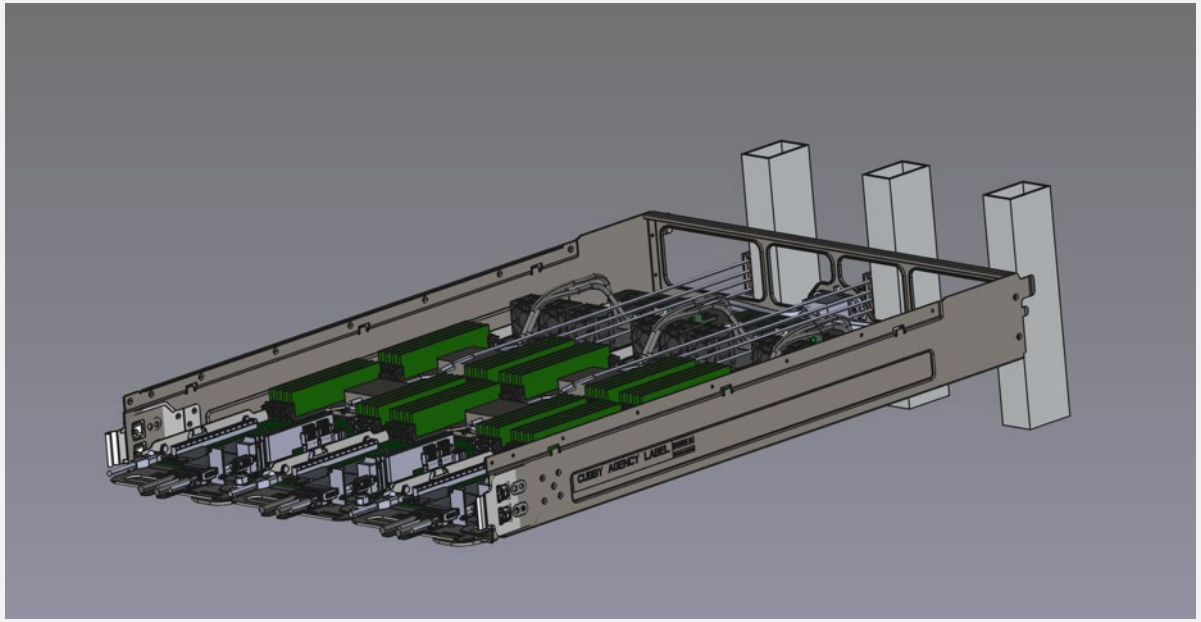
3% of server energy
(by reducing quantity or RPM)

Twice as dense

OCP Leopard servers



OCP Leopard servers with LHP

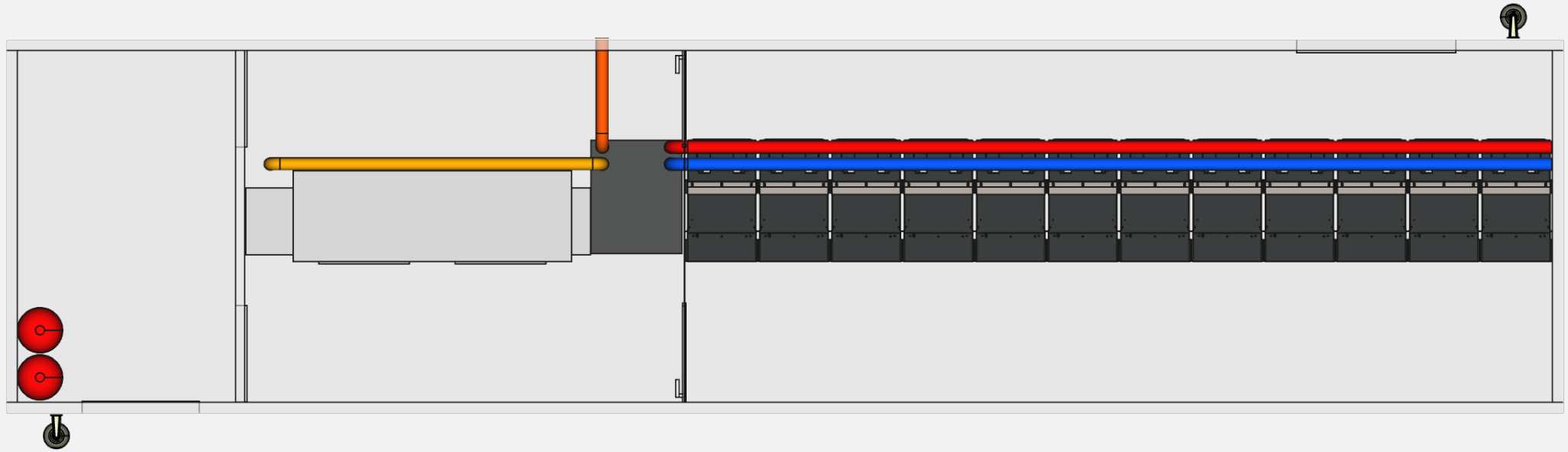


Twice as dense

Open Rack V2 (45 servers)

Open Rack V2 with passive liquid cooling (84 servers)

12 racks / 1000 servers (Air 250 serves)



Cool aisle temperature with air cooled CPU

Table 15. Maximum continuous operating temperature for dual processor with 2.5-inch direct / 2.5-inch NVMe drive configuration - Air cooled

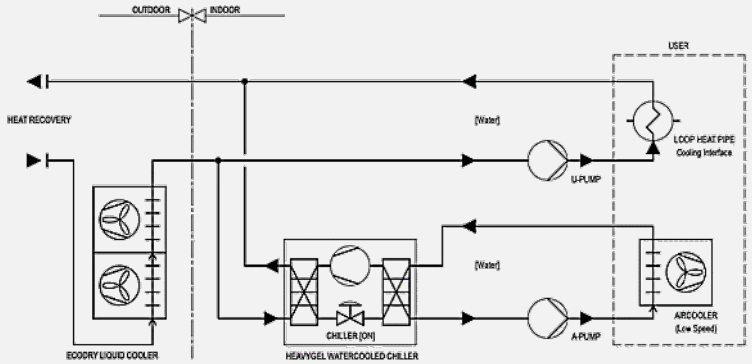
CPU	TDP	Cores	24 x drives	16 x drives	8 x drives	4 x drives	No BP
7513	200	32	20	20	25	25	30
7443	200	24	20	20	25	25	30
7413	180	24	20	20	25	25	30 (-2)
7313	155	16	25	25	25	25	30
7662	225	64	Not supported	Not supported	Not supported	Not supported	20
7713	225	64	Not supported	Not supported	Not supported	Not supported	20
7543	225	32	Not supported	Not supported	Not supported	Not supported	20
7763	280	64	Not supported	Not supported	Not supported	Not supported	Not supported
7H12	280	64	Not supported	Not supported	Not supported	Not supported	Not supported

Table 17. Maximum continuous operating temperature for dual processor with 2.5-inch direct / 2.5-inch NVMe drive configuration - Liquid cooled

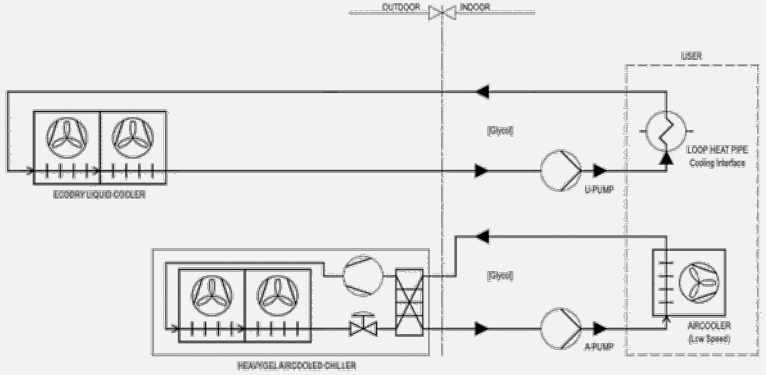
CPU	TDP	Cores	24 x drives	16 x drives	8 x drives	4 x drives	No BP
7513	200	32	35	35	35	35	35
7443	200	24	35	35	35	35	35
7413	180	24	35	35	35	35	35
7313	155	16	35	35	35	35	35
7662	225	64	35	35	35	35	35
7713	225	64	35	35	35	35	35
7543	225	32	35	35	35	35	35
7763	280	64	35	35	35	35	35
7H12	280	64	35	35	35	35	35
7742	225	64	35	35	35	35	35
7642	225	48	35	35	35	35	35
7542	225	32	35	35	35	35	35

4 flexible heat reuse schemes

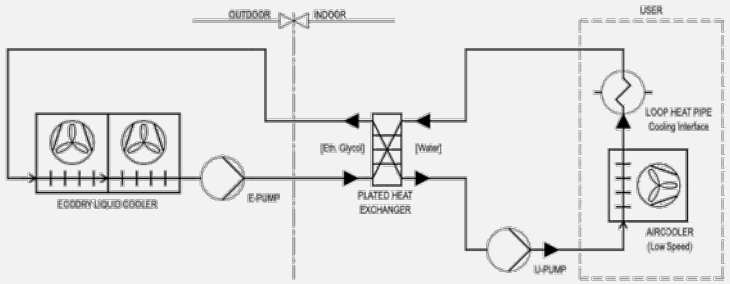
with water cooled chiller



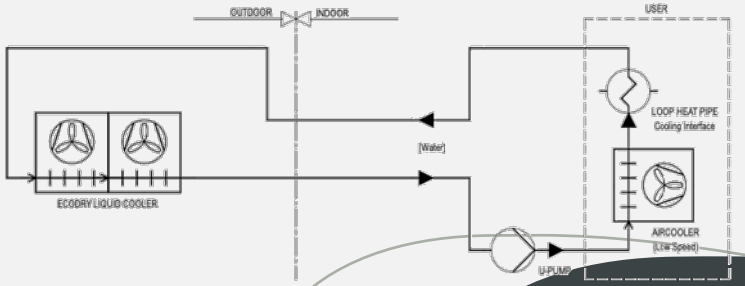
with air cooled chiller



with adiabatic cooler (2 circuits)



with adiabatic cooler (1 circuit)



Passive liquid cooling

Ambient air

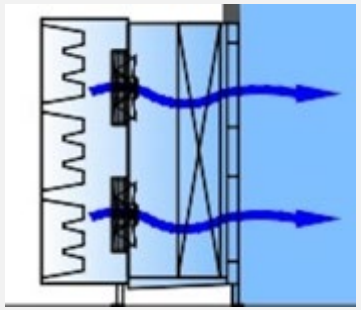
-18…+34°C

13 kW

335 kW

27°C

Air cooler 1 kW



30°C

42°C

85 kW

Air for servers

35°C

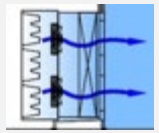
58°C

Rack Thermal Manifolds

250 kW

Passive liquid cooling

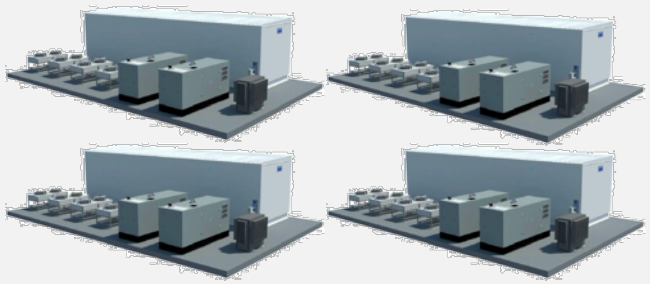


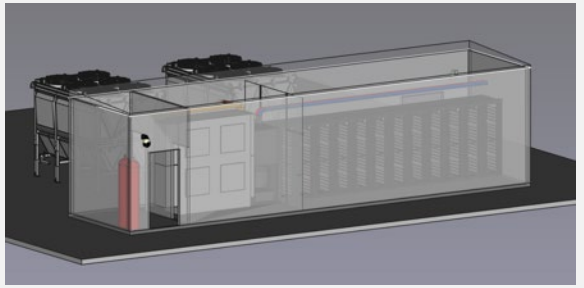


	Adiabatic cooler	Pumps	Air cooler	Servers	UPS	Total
kW	13	4	1	335	17	369
Hours	8760	8760	8760	8760	8760	
MWh	32	34	6	**2935**	149	**3 155**

$$\mathbf{PUE} = \frac{\text{Total energy}}{\text{IT energy}} = \frac{3155}{2935} = 1.08$$

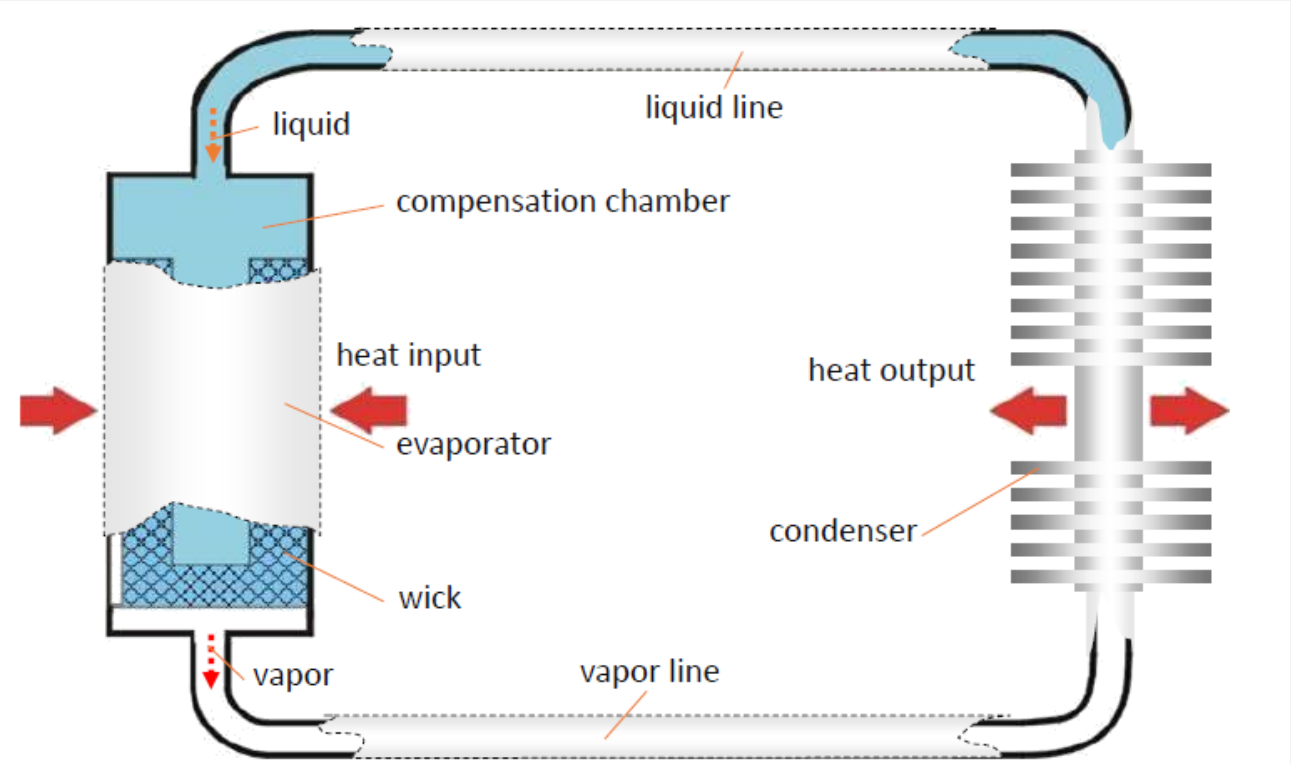
TCO Comparison





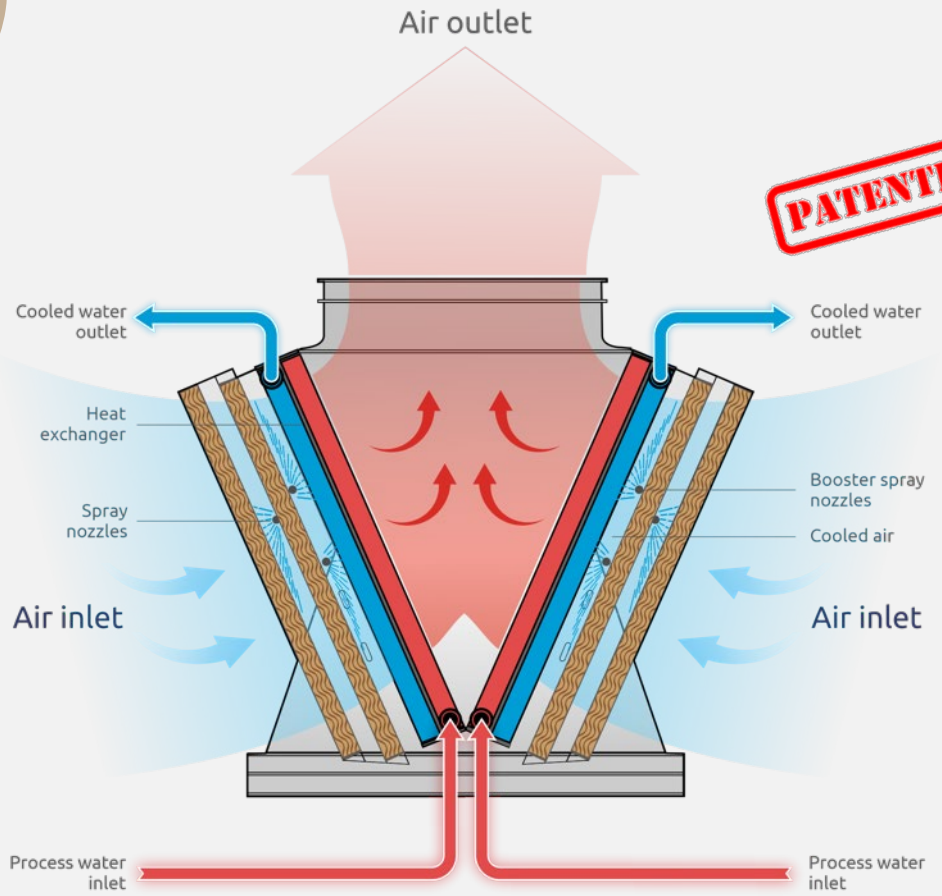
	Air	Passive Liquid	Savings, %
Servers	1000	1000	-
Racks	48	12	-75%
IT-load	360 kW	335 kW	-7%
Total power	576 kW	369 kW	-36%
Cooling energy	1508 MWh	72 MWh	-95%
Total energy	4836 MWh	3155 MWh	-35%
TCO, k€/3 years	3682k€	2497k€	-34%

Loop Heat Pipes (LHP) based Passive Liquid Cooling system

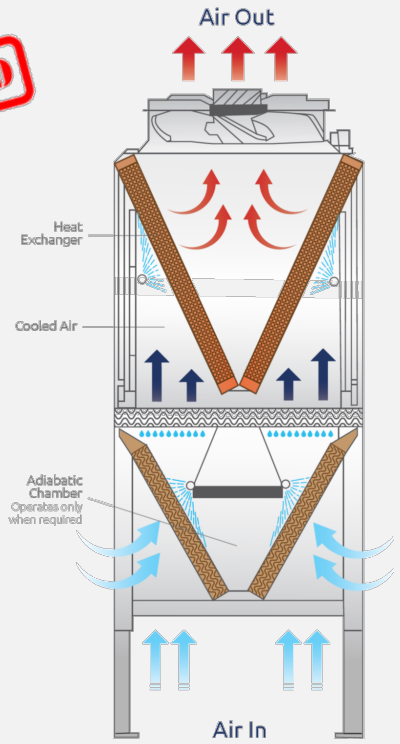


- Passive liquid cooling system
  - No moving parts, valves or pumps
  - No energy or water spending
- Direct-to-chip cold plate cooling
  - Simple installation / removal
  - High efficiency: up to 1kW chips
- Maximum tolerance to:
  - Gravity field and distance
  - Multiple bending for any server topology
- No risk of leakage of any kind
  - Capillary structure + negative internal pressure
- No maintenance needed. Up to 20-year lifetime.

How does it work?



PATENTED



- Runs as Dry Cooler as long as possible
- When needed, air is cooled in the closed adiabatic chamber before reaching the heat exchanger coil
- Closed loop cooling system with moisture absorbent material honeycomb interior
- Reduces water consumption and energy use
- Highly adaptable to different applications / climates

WATER SAVING
Minimized Water Footprint
-95%

Energy Savings
Reduced Operating Costs
-40%

Maintenance Costs Savings
Chemicals & water treatment
-95%

No risk of Legionella

Thank You
and visit us at booth D320

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