OPEN POSSIBILITIES.

The Circular Economy Meets Immersion Cooling: An Integrated Solution

Andy Young (CTO Asperitas) & Erik Riedel (CTO ITRenew)

OCP GLOBAL SUMMIT
NOVEMBER 9-10, 2021

The Circular Economy Meets Immersion Cooling: An Integrated Solution

Andy Young, CTO, Asperitas
Erik Riedel, CTO, ITRenew

OPEN POSSIBILITIES.

Collaboration with partners

ADVANCED COOLING SOLUTIONS

- Circular Economy approach with 2 platinum OCP members working together
- Integrated solution will see the Asperitas AIC24 21” module fitted with the OCP standard ITRenew Sesame hardware stack
- Working towards building a sustainable and high-density immersion cooled platform anywhere
- Energy efficiency, scalable and heat reuse ready
- Working towards energy neutral datacentre industry
- Helps reduce e-waste and CO2 production
- Each Immersed Computing® system will come integrated with 24 1U cassettes with three nodes each, making a total of 72 nodes and two integrated switches

OPEN POSSIBILITIES.

OCP membership and alliances

ADVANCED COOLING SOLUTIONS

- OCP is the place to collaborate
- Asperitas and ITRenew are both active OCP members
- Partnership exemplifies joint proposition of developing low carbon solutions in both the pre-use and use phase

- Joining forces to integrate OCP Marketplace listed products
  - Asperitas AIC24 module and trolley
  - ITRenew servers, dense GPU solutions, and switches

Key member contributions to OCP

- Immersion cooling technology first to comply with Open Compute Project immersion requirements
- Contribution to ACS immersion group
- The first fully supported route to remarketed OCP marketplace servers
- Sustainable hyperscale technology at disruptive economics
- Integrated solution that is sustainable, dense and resilient

Immersion cooling

ADVANCED COOLING SOLUTIONS

- Asperitas AIC24, high integrity and optimised for thermal performance
- Natural convection, no moving parts, no pumps
- Shell Immersion Cooling Fluid (S5X)
- Materials compatibility

Case study on OCP Leopard 2-socket

ADVANCED COOLING SOLUTIONS

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- Converting Leopard sled for immersion
- Re-packaging 2OU into 1U Open cassette
- Challenges, solutions, benefits
- Tooling: CFD, immersion testing

OPEN Compute Project SOLUTION PROVIDER®

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Leopard: Server details

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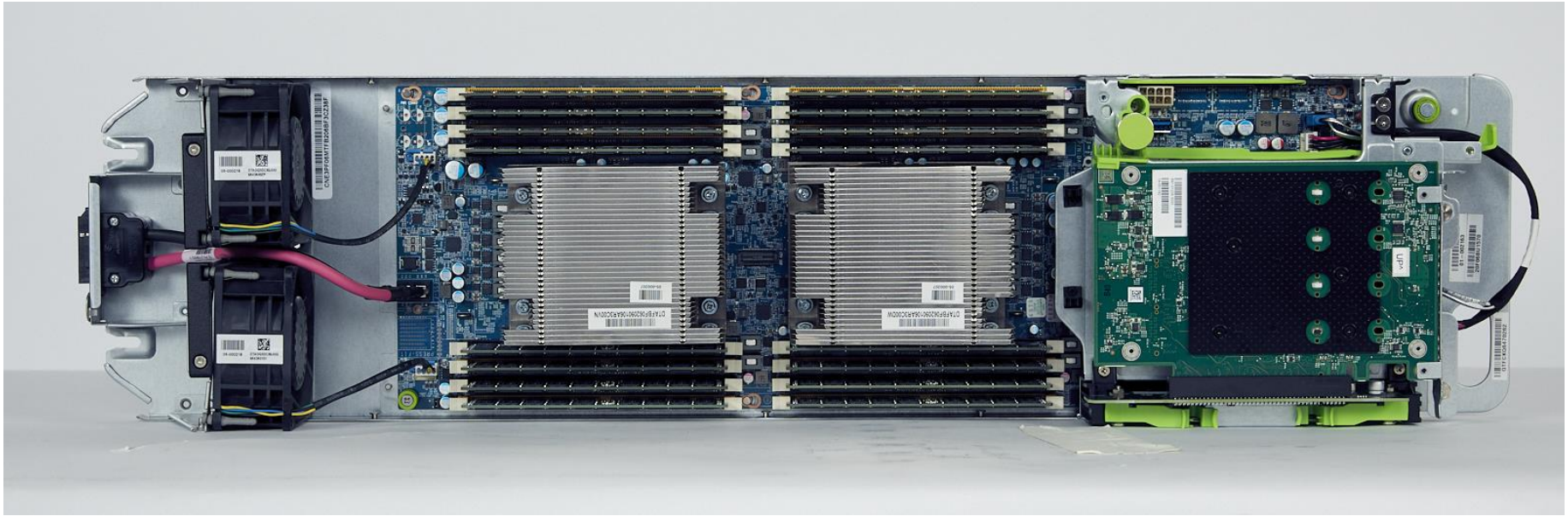
ADVANCED COOLING SOLUTIONS



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Leopard: Key component details

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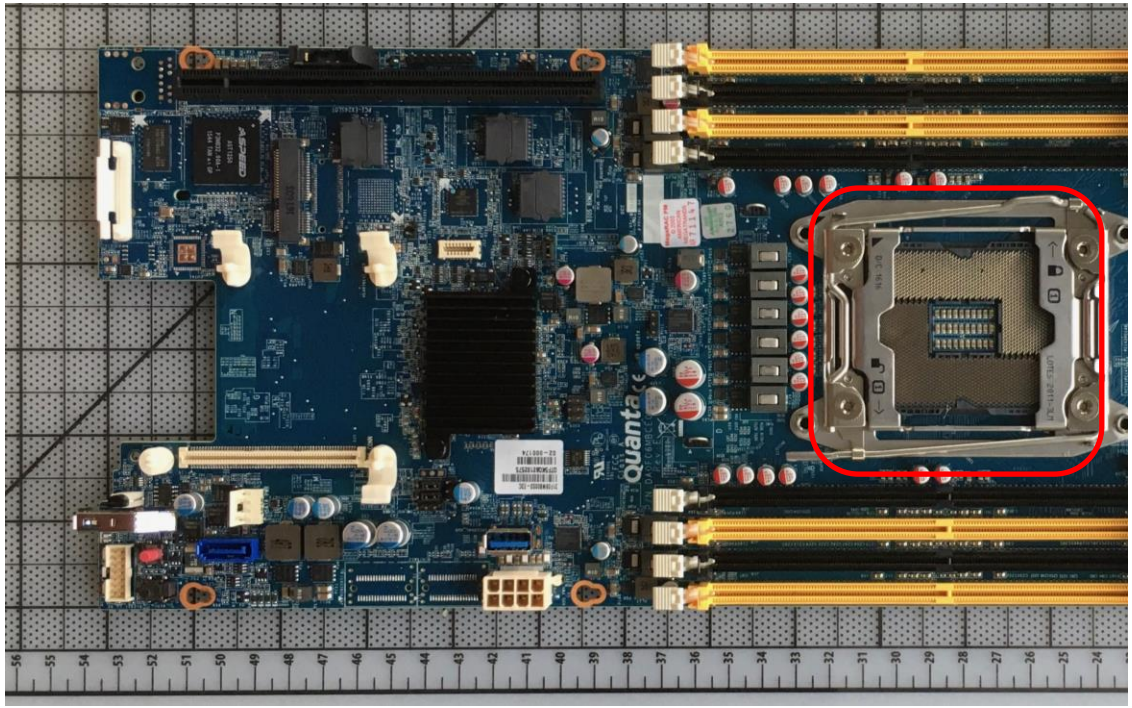

Intel® Xeon E5-2678V3
TDP of 120W, Tc-max=84.5°C

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Leopard: Key component details

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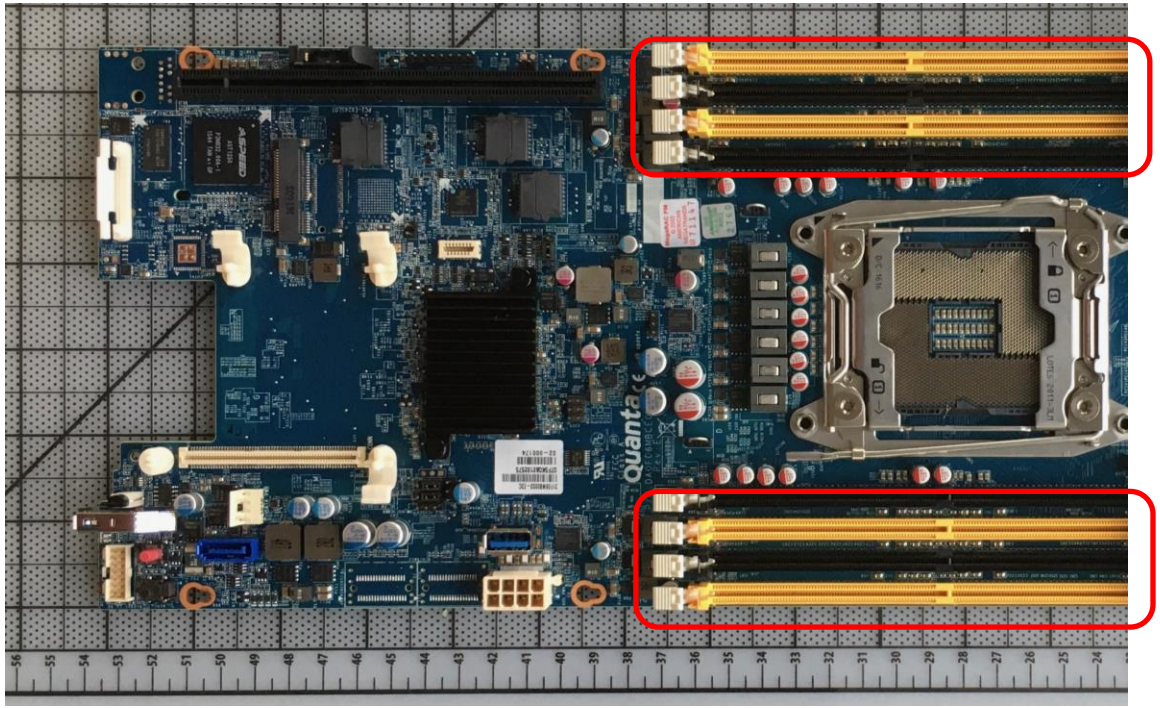

48x DDR4 DIMMs
TDP of 10W ea., Tc-max=85°C

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Leopard: Key component details

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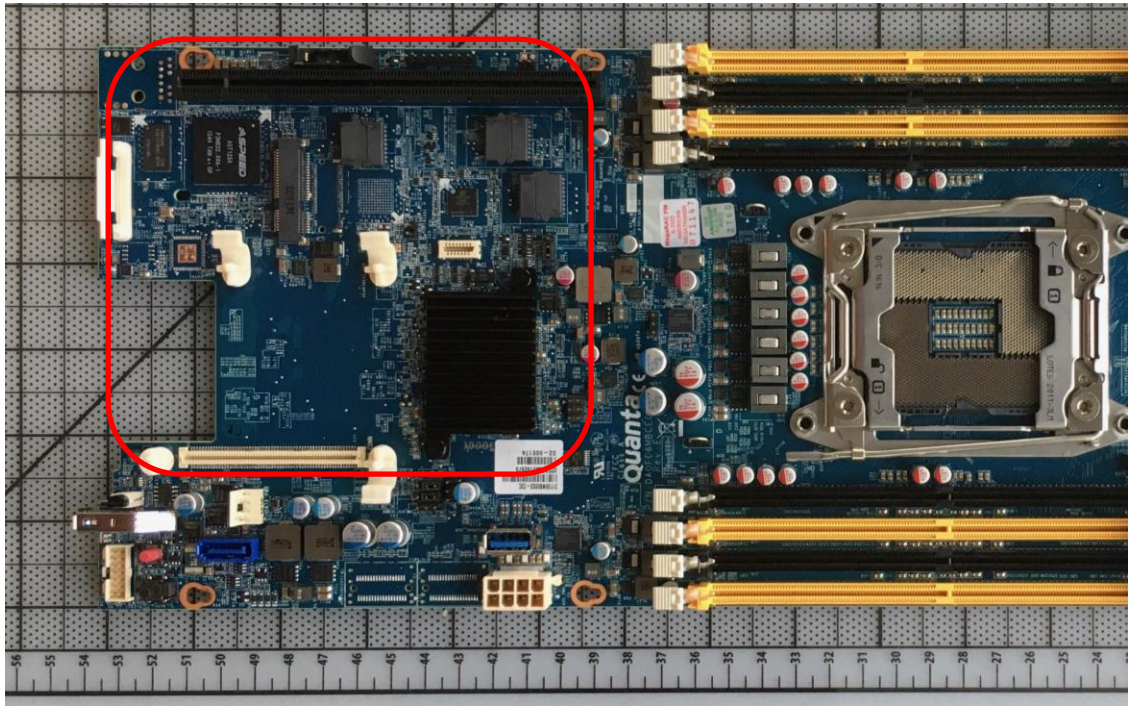
ADVANCED COOLING SOLUTIONS



AVA-4 m.2 x4 SS
TDP of 8W ea., Tc-max=70°C

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Leopard: Key component details

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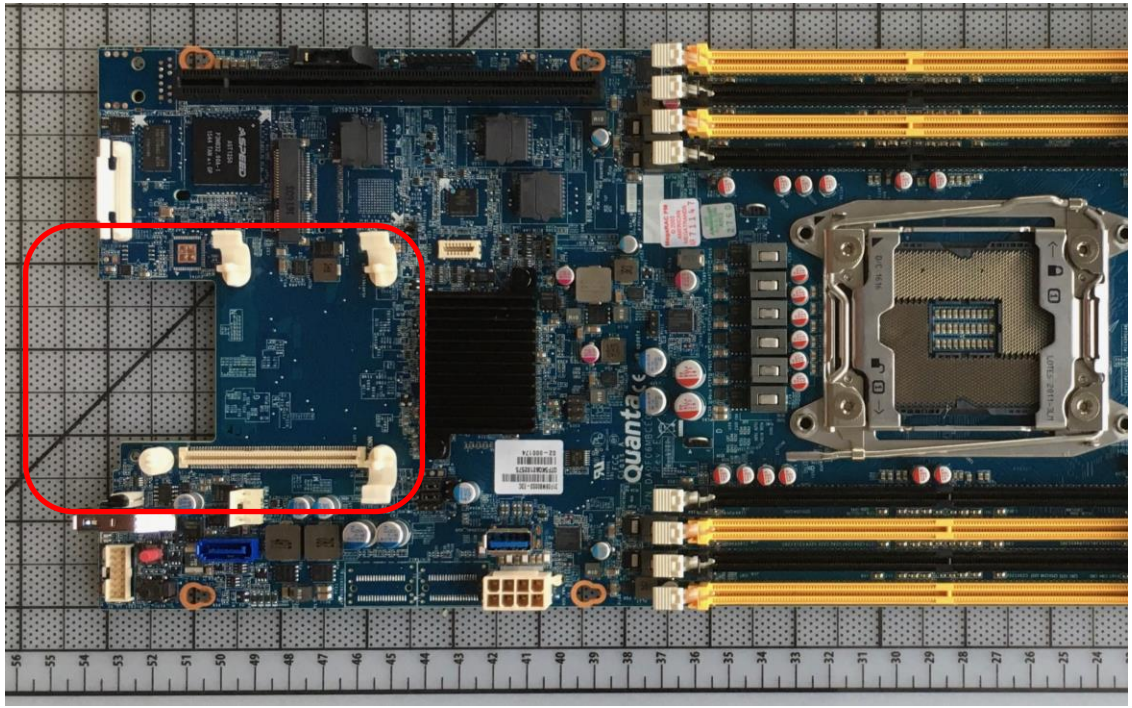
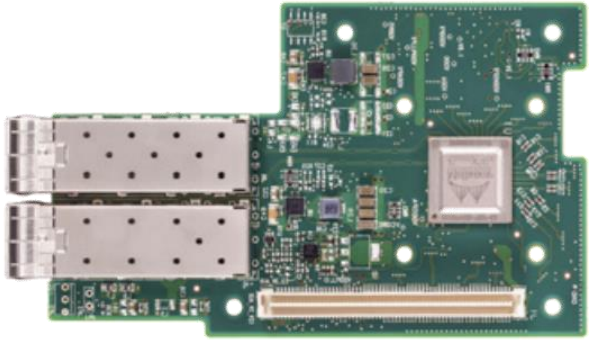
ADVANCED COOLING SOLUTIONS





NIC mezzanine card
TDP of 14W, Tc-max=90°C

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Leopard: Key component details

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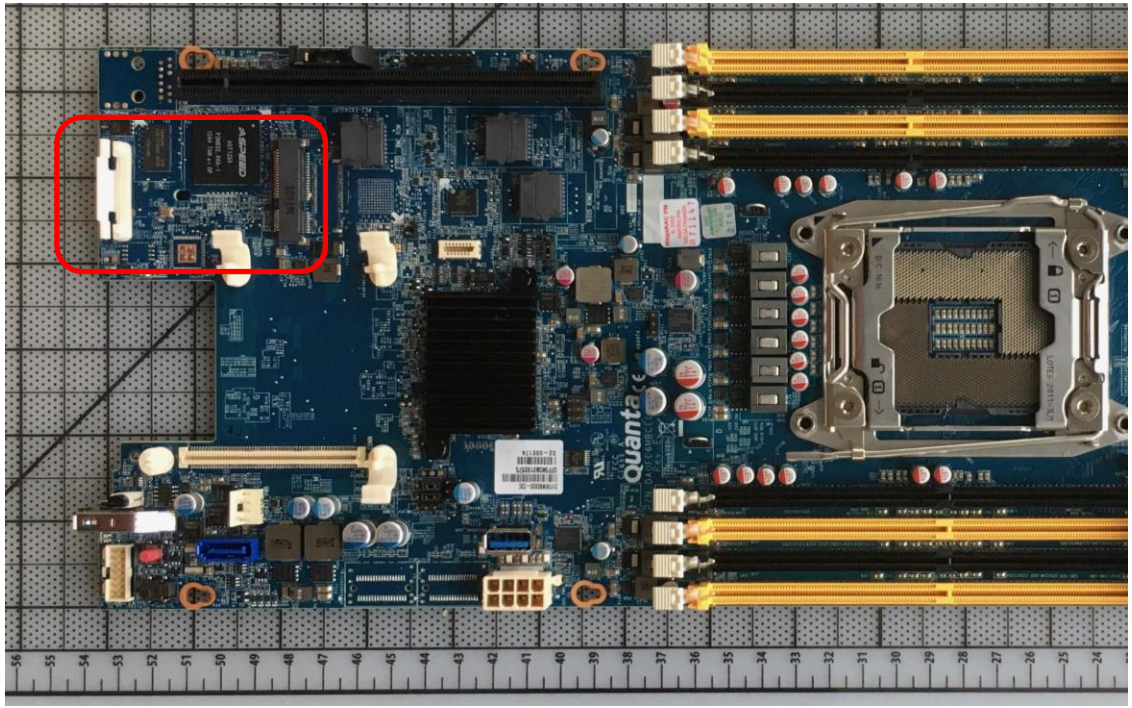
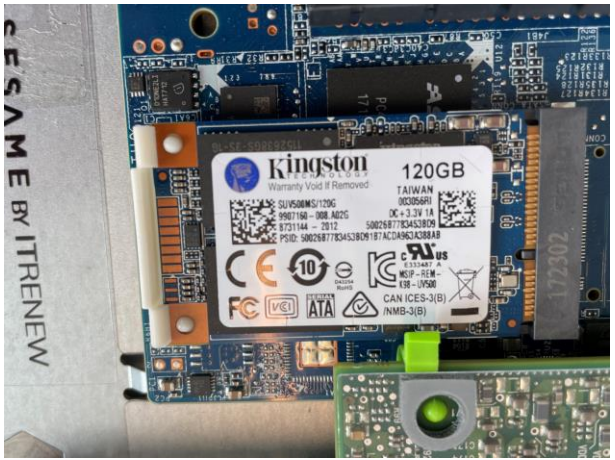
ADVANCED COOLING SOLUTIONS





SSD

TDP of 8W ea., Tc-max=70°C

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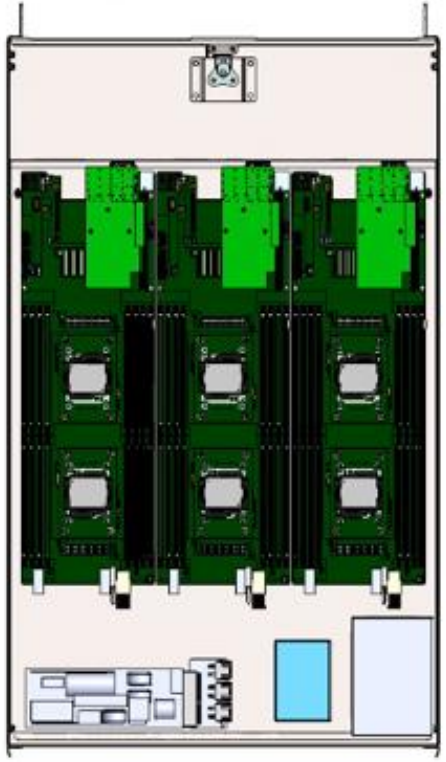
Layout configurations options

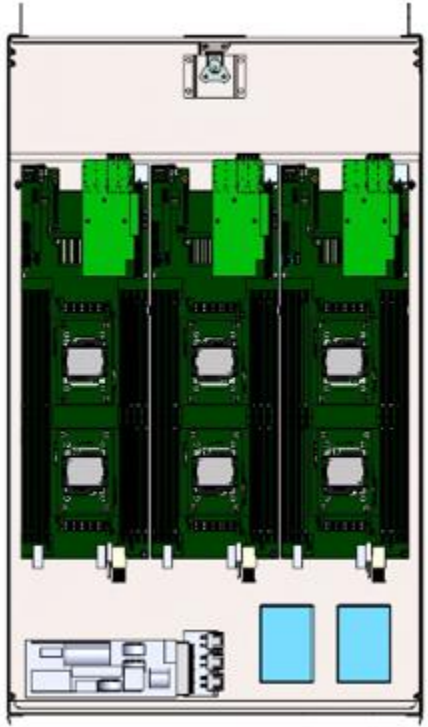
ADVANCED COOLING SOLUTIONS



Options 1: 2x 2.5”HDDs, stacked (SSD), 1x 3.5”HDDs

Pros: we can fit 1x 3.5”HDD in the cold (stable) part of the server

Cons: we can only fit two 2.5”SSDs along-side, and 3.5” impedes flow, cable routing challenge for the right-hand server

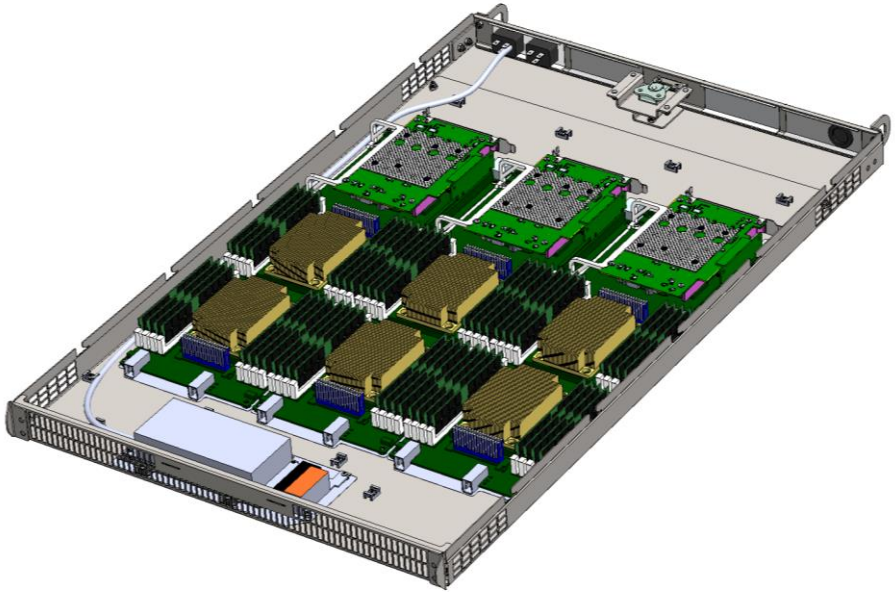


Option 2: 4x 2.5”HDDs, stacked (SSD), no 3.5”HDDs

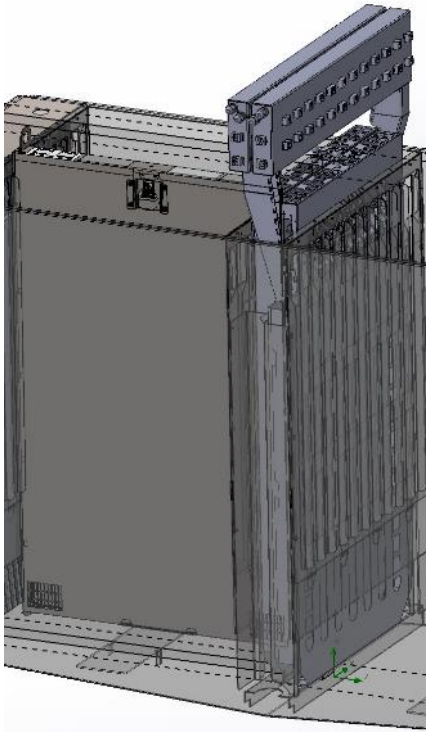
Pros: we can fit 4x 2.5”SSD in the cold (stable) part of the server

Cons: no 3.5” HDD

CFD modelling



CFD model: server context



CFD model: Module context

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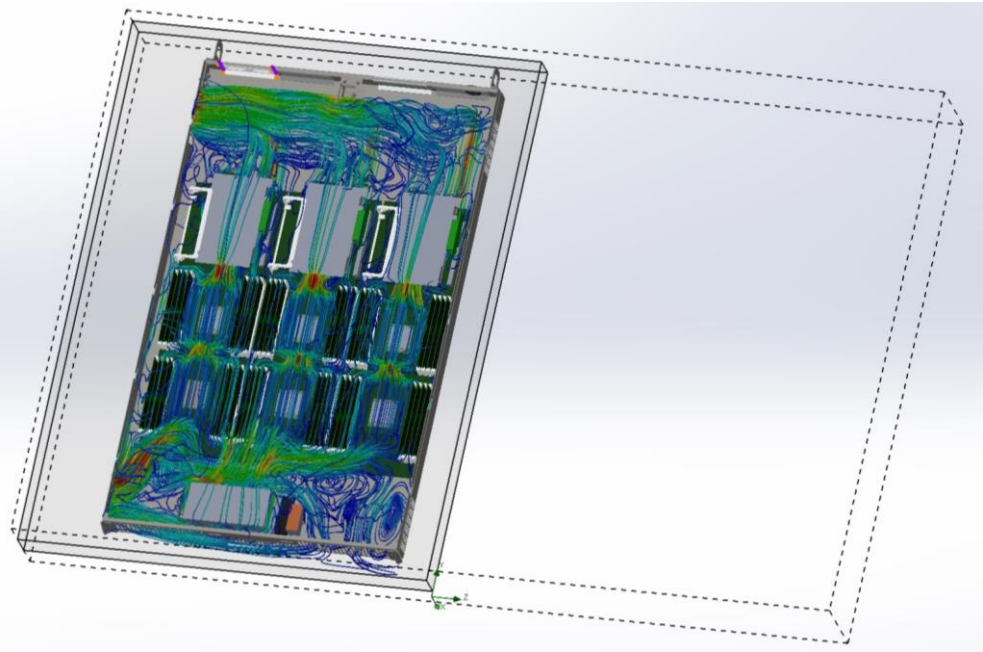
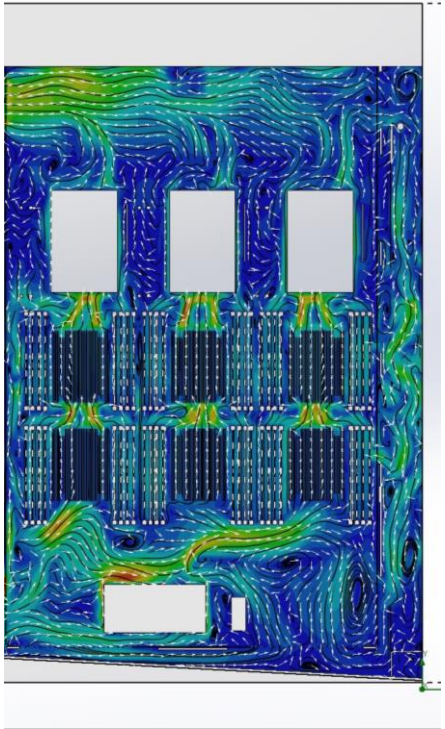
CFD modelling:
Natural convection flow distribution





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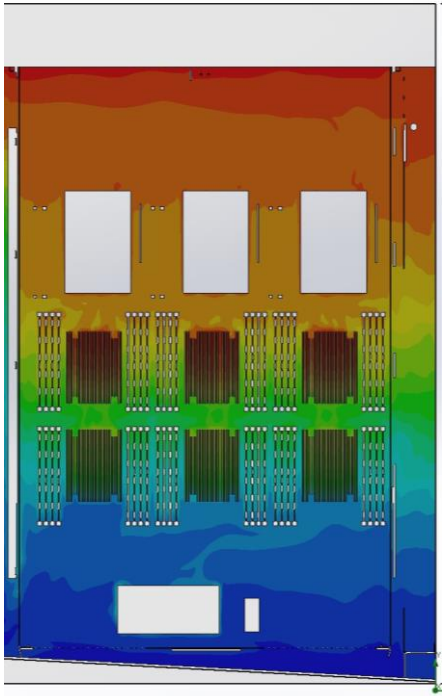
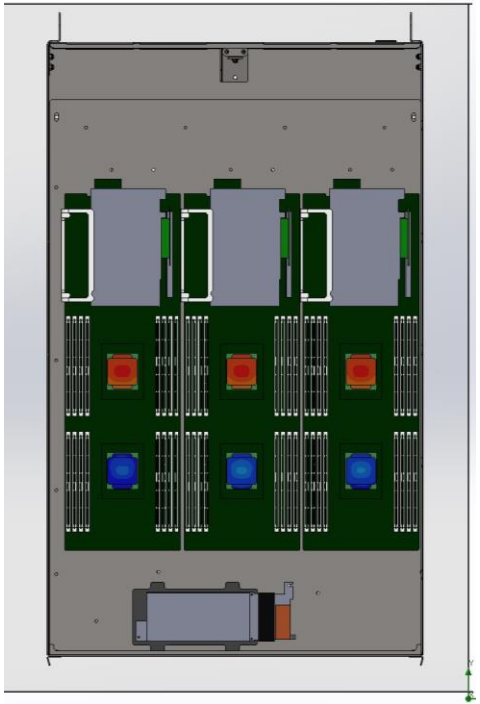
CFD modelling:
Natural convection flow distribution

ADVANCED COOLING SOLUTIONS



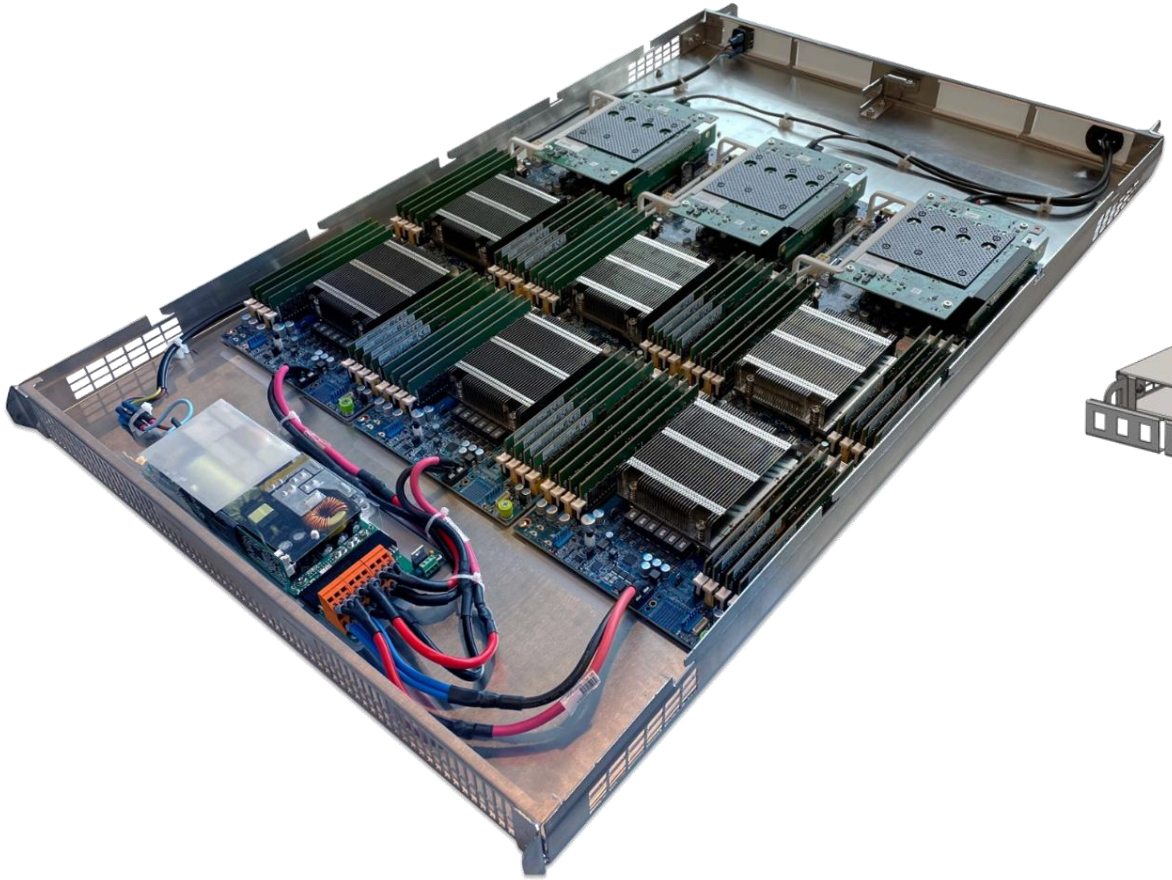


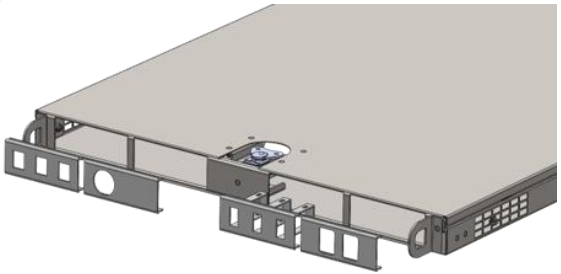
At 40°C water inlet temperature:

- CPU case: 84.5, 69-70, 15K
- DIMMs: 85, 70 max, 15K
- PSU 85, 65, 20K

Therefore minimum margin 15K

Water inlet temperature max = 55°C





ADVANCED COOLING SOLUTIONS

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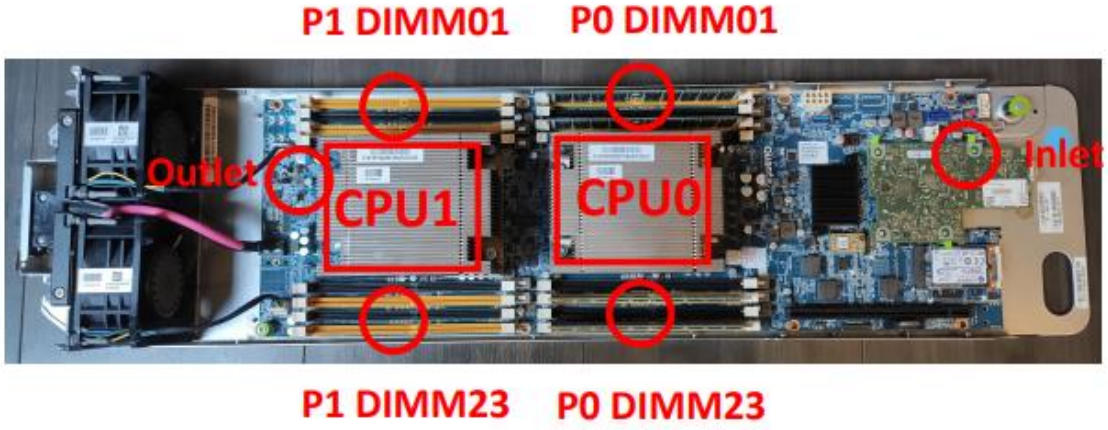
ITRenew Air Benchmark

ADVANCED COOLING SOLUTIONS



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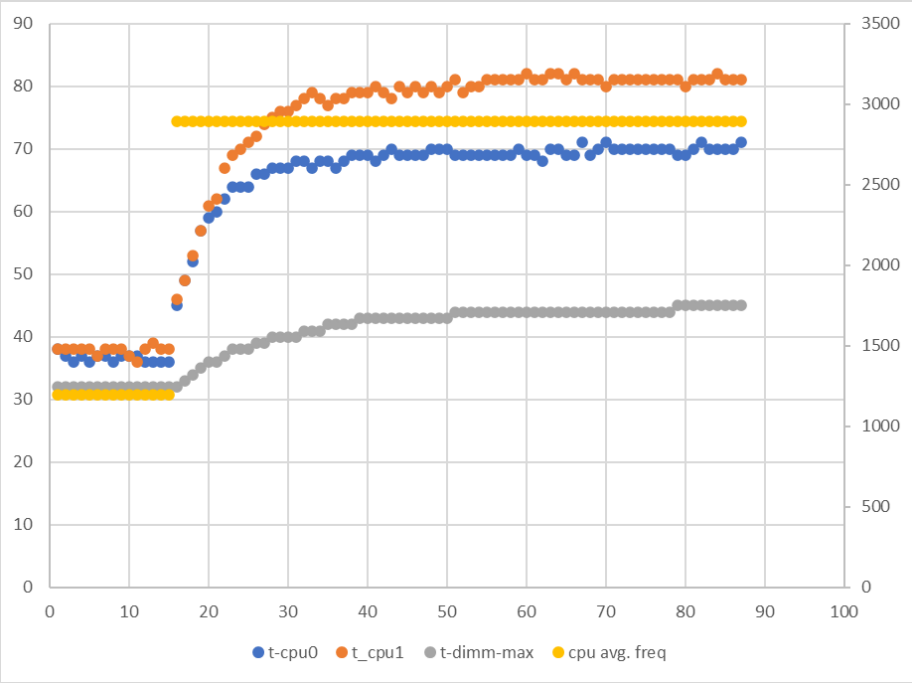
ITRenew Air Benchmark

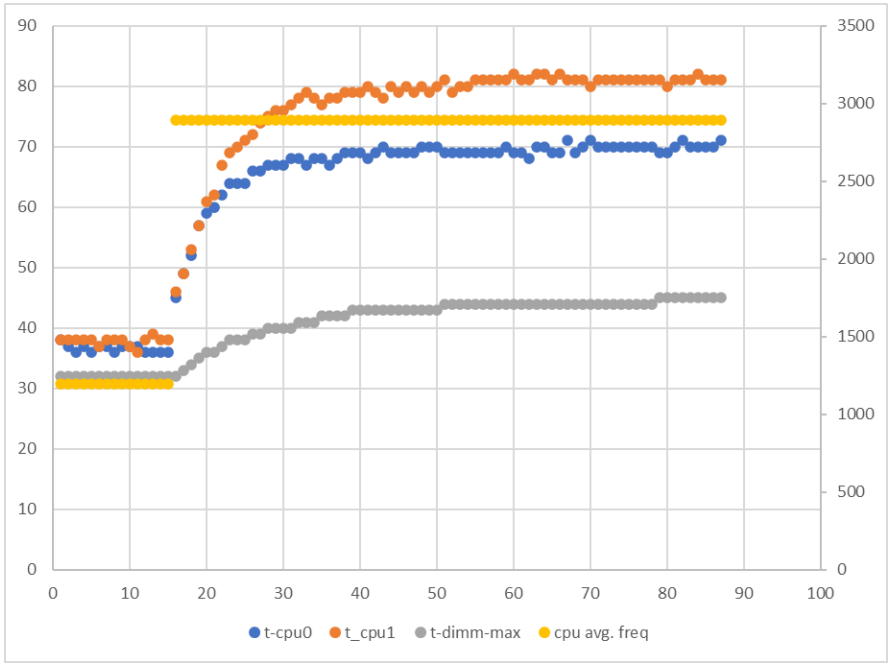
ADVANCED COOLING SOLUTIONS

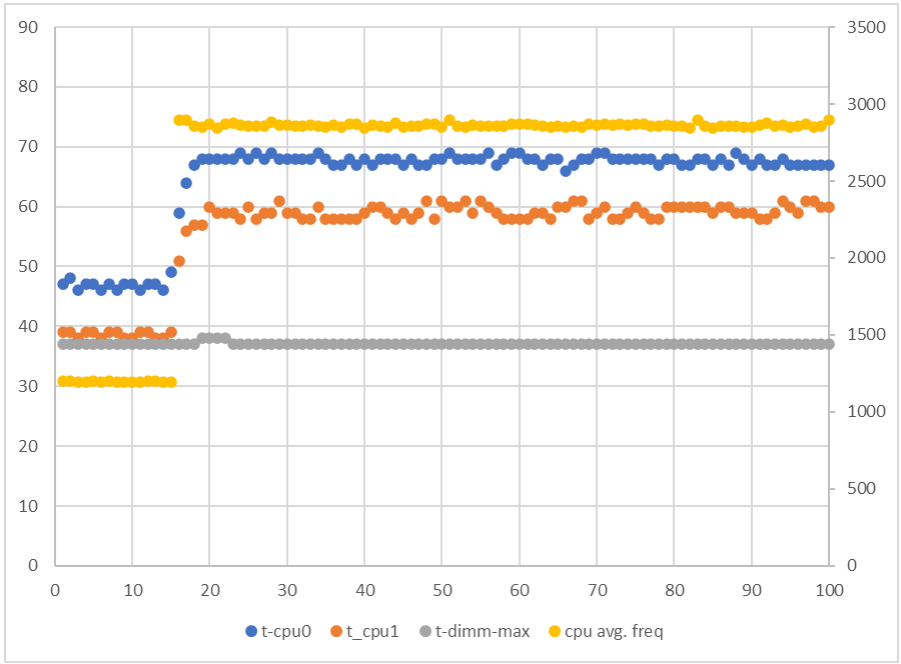


Sensor	Value
Average Inlet temp °C	25,10
Average max outlet temp °C	57,33
Average P0 max temp °C	70,00
Average max temp °C	83,33
Average P0 min temp °C	35,33
Average P1 min temp °C	37,00
max delta P1;P0 °C	15,00
Average delta P1;P0 °C during burn	12,70
Average DIMM max temp °C	32,00
Average DIMM min temp °C	31,33
Average Idle power consumption	80,40
Average burn power consumption	340,56

ITRenew Immersion Benchmark

ADVANCED COOLING SOLUTIONS





Air inlet temperature 25ºC

Water inlet temperature 20ºC

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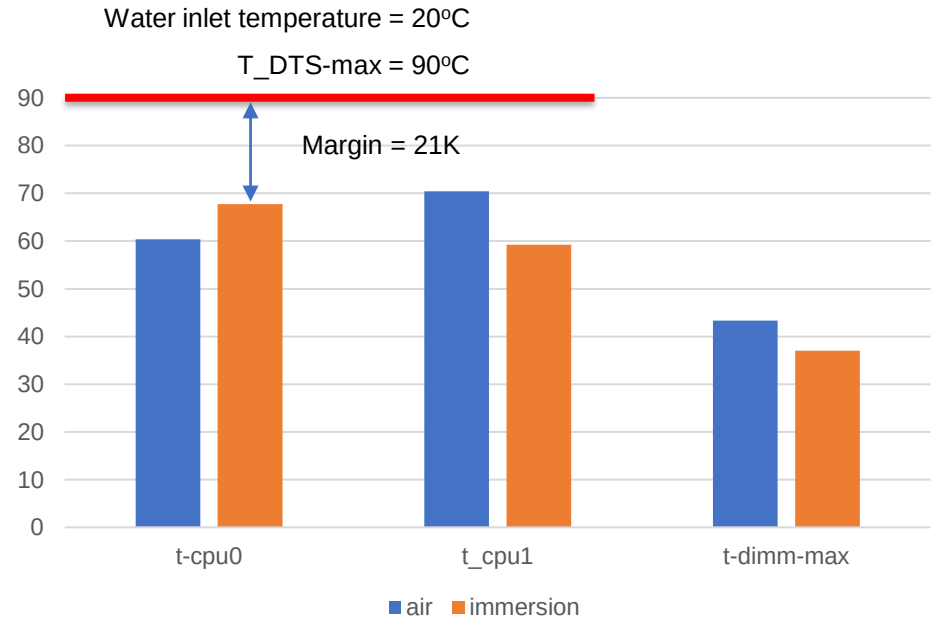

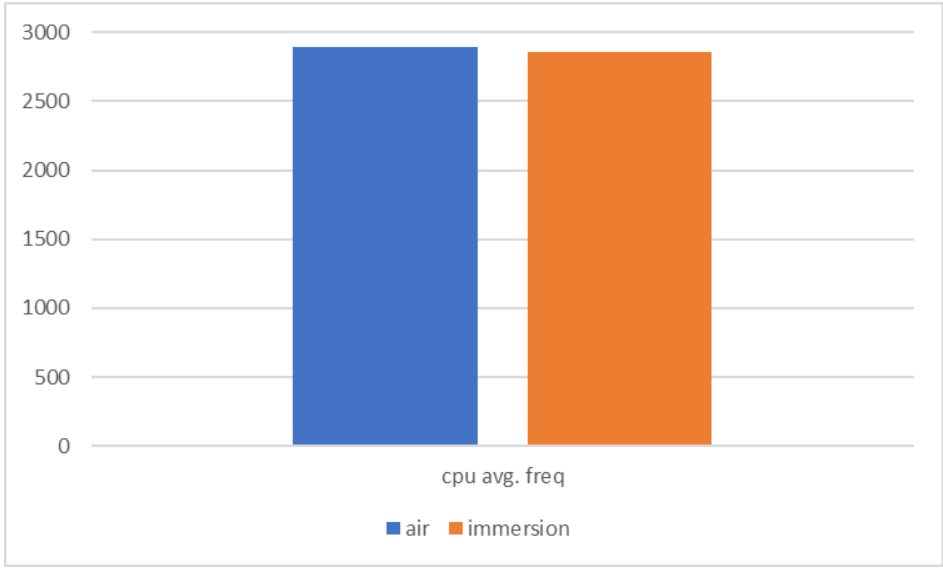

Water inlet temperature max. = 41ºC

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Also in progress: Big Basin GPU server

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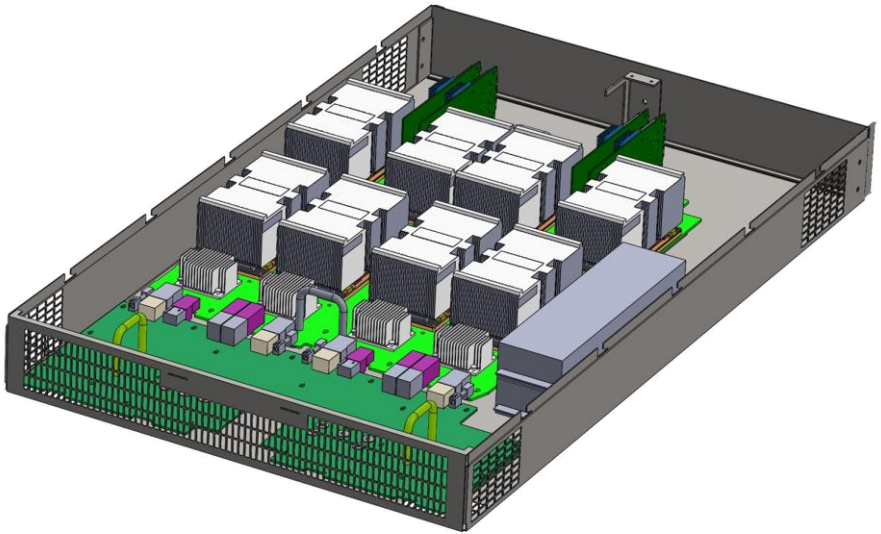

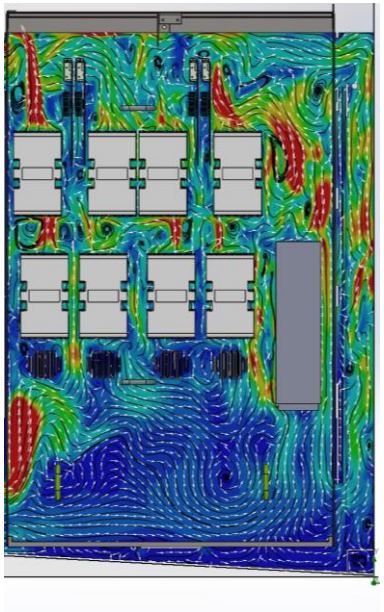

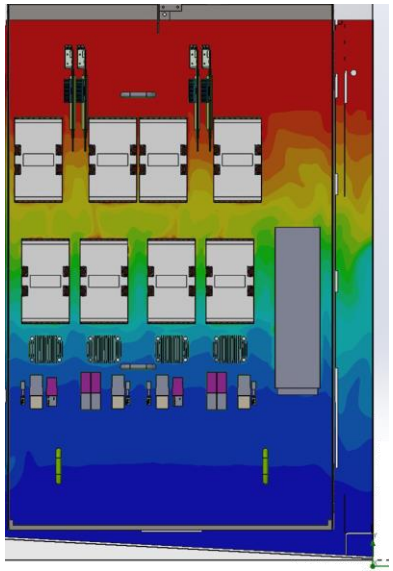

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Summary

Immersion cooling and extending first lifetime value of datacentre technology

Working together through OCP to achieve

- **Immersion ready solutions**
- **Carbon reduction**
- **Reliability**
- **Warm water cooling at 41ºC**
- **Enabling heat reuse**
- **Circular economy**

OPEN POSSIBILITIES.

Call to Action

- **Join and contribute** immersion related content in ACS Immersion, Server and ACF groups
- **Collaborate** on optimization of IT platforms for immersion
  - **Cross-pollination** within OCP builds an effective ecosystem
  - **Sharing knowledge** helps increase the immersion potential
- More information: andy.young@asperitas.com
- ACS Immersion Project Wiki with latest information
  - https://www.opencompute.org/wiki/Rack_%26_Power/Advanced_Cooling_Solutions_Immersion_Cooling
  - Mailing list: http://lists.opencompute.org/mailman/listinfo/opencompute-acsimmersion

References

- OCP new submissions
  - Asperitas tank qualification & product listing (Asperitas)
  - ITRenew immersion cooling server product listing (ITRenew)
  - Integrated product listing (Asperitas & ITRenew)

- OCP Marketplace Solutions
  - https://www.opencompute.org/sustainability-solutions/5/sesame-by-itrenew-for-kubernetes
  - https://www.opencompute.org/sustainability-solutions/4/sesame-by-itrenew-for-hyper-converged

- OCP related specifications
  - https://www.opencompute.org/documents/20200227-open-cassettes-specification-v1-0-pub-pdf
  - https://www.opencompute.org/documents/design-guidelines-for-immersion-cooled-it-equipment-revision-1-01-pdf
  - https://www.opencompute.org/documents/ocp-acs-immersion-requirements-specification-1-pdf

- Sesame by ITRenew: www.sesame.com
- Asperitas: www.asperitas.com

Thank you!